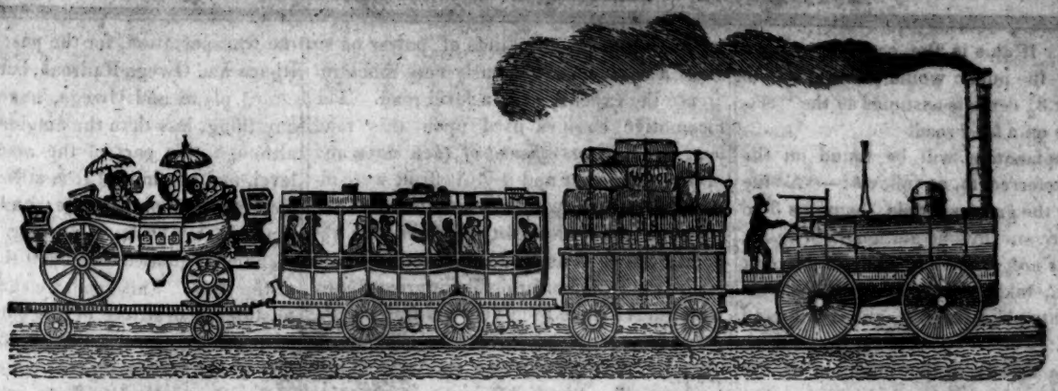

AMERICAN RAILROAD JOURNAL,
AND ADVOCATE OF INTERNAL IMPROVEMENTS

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D. K. MINOR, EDITOR.] SATURDAY, MARCH 12, 1836. [VOLUME V.—No. 10.

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AMERICAN RAILROAD JOURNAL.

NEW-YORK, MARCH 12, 1836.

REMOVAL.—The Office of the RAILROAD JOURNAL, NEW-YORK FARMER, and MECHANICS' MAGAZINE, is removed to 132 *Nassau street*, opposite CLINTON HALL, and two doors *below Beekman street*.

☞ Will those Editors to whom the Journal is sent, do me the favor to notice this removal, send their papers in exchange, and request the friends of the Periodicals in the country to direct their orders to me at 132 Nassau street.

The favor shall be reciprocated at any and all times, by

D. K. MINOR.

March 23, 1836.

We give in this week's paper the result of the trial on the Baltimore and Ohio Railroad, by which it will be found that the locomotive then used performed the almost incredible task of drawing nearly 26 tons up inclinations above 220 feet per mile, and starts from perfect rest on a plane of 264 to the mile, (or 1 foot in 20,) with a load of 20¼ tons.

For the information of those who may be incredulous, we give the report of the Committee at length.

We need not call attention to the fact, that this development of the capacities of locomotives will lead to the most important results—the one, that the *valley of the Ohio may be reached from the seaboard without the use of stationary, or even additional power*, is, in itself, a splendid instance of the benefit of perseverance over every possible moral and physical obstacle that could be interposed.

We acknowledge the receipt of a number of public documents of considerable interest, for which we beg to return thanks. These, as well as several communications on hand, shall be attended to as soon as time and space will permit.

As much interest is felt on the subject of widening the Canal, we have given the Commissioners' report, and shall give so much of those of the Engineers' as relates to general location, &c.

To the Editor of the Railroad Journal:

Since my last communication I have witnessed the disappearance of the spots I then mentioned as being seen on the surface of the sun. Yesterday I again observed many more, and much larger ones. Seven very distinct spots could be counted. They are singularly grouped in threes, elongated, and directed parallel to the sun's equator.

Can there be any connexion between these phenomena and the singular weather we have experienced?

If, as Herschell maintained, their effect is to expedite vegetation, may it not be that they are to accelerate our tardy spring?

Would not experiments, as to the magnetical effects of the sun's rays at this time, be particularly important?

I throw out these hints for those who may take so much interest in these matters as to undertake to make these or similar observations.

G. C. S.

New-York, March 28th, 1836.

For the Railroad Journal.

STRICTURES ON THE REPORTS OF THE STATE ENGINEERS.

No. I.

D. K. MINOR, Esq.:

The discussion upon the bill now before the New-York Legislature, relative to a loan to the New-York and Erie Railroad Company, recalls to mind some of the circumstances *connected* with the proceedings upon that subject during the last session.

Among other things, the Canal Commissioners were called upon to report upon the comparative merits and cost of Railroads and Canals. In the performance of this duty, they brought to their aid three individuals, viz: John B. Jervis, Holmes Hutchinson, and Frederick C. Mills, who, they say, are "Civil Engineers of experience in the construction of Canals and (!) *Railroads*."

In the report made by these gentlemen, it is stated, p. 33, that "*experience* thus far has *settled* the cost of transportation upon Railroads at 3½ cents per ton per mile *on a level road*," and that "this allows no profit or toll." On the page preceding, they say, that "the cost of transportation (*reduced to a level road*,) on the Baltimore Road, *we have found to be* $3\frac{4}{100}$ *cents per ton per mile*."

These estimates, it will be perceived, are both for a *level road*. If the latter is true, the course of reasoning, by which the conclusion first stated was attained, is entirely beyond our comprehension.

Again it is stated, p. 27, that "the *actual* cost of transportation on the Mohawk and Hudson Railroad, for freight by locomotive and stationary steam, is 3½ cents per ton

per mile." If this is the *actual* cost upon that road, the public would perhaps like to know why 3½ cents is assumed as the "settled" price on a *level* road.

The explanation will be found on the page last referred to, as follows:—"All the ascent for the greatest trade, (being as 3 to 1,) is overcome by one stationary engine, which *does not materially enhance the cost over a level*, taking the whole road." Putting this into plain English, and it will read as follows:—

"All the ascent in the direction of the heavier trade (the weight of which is to that in the opposite direction as 3 to 1,) is overcome by one stationary steam engine, which does not materially enhance the cost of transportation, compared with a level road of equal length."

The process, by which the gentlemen mentioned arrived at their conclusions, respecting the cost on a level road, is therefore evident.

1st. They *assume* the *actual* cost on the Mohawk and Hudson Road to be 3½ cents per ton per mile.

2d. They come to the very extraordinary conclusion, that the cost of transportation upon that road is *not materially greater than it would be upon a level road of the same extent.*

3d. They "find" that on the Baltimore and Ohio Road the cost of transportation, when reduced to a *level*, is but $3\frac{5}{100}$ cents per ton per mile; yet they nevertheless conclude, that "experience" has "settled" the cost at 3½ cents.

The authority for the statement in relation to the Mohawk and Hudson Road is not known.

In respect to the conclusions in reference to that road, it may perhaps be well to devote a little attention.

The Mohawk and Hudson Road is 15⅞ miles in length. It has two inclined planes, whereon stationary steam power is used.—The elevation overcome by these planes is, for the western one, 113¾ feet, and for the eastern 172½ feet. The total ascent from the Erie Canal at Schenectady is 113¾ feet, and the descent to the Hudson River at Albany, is 325½ feet—making a total rise and fall of 439 feet. The same proportion of rise and fall estimated for the New-York and Erie Railroad, the distance being 483 miles, would give 13,400 feet—an amount sufficient, so far as elevation is concerned, to carry it over the Rocky Mountains!!!

Between the inclined planes and the termini of the Mohawk and Hudson Road, horse power is required. Between the inclined planes, locomotive, steam, and horse power are both used. The peculiar arrangement of this road has required, therefore, the use of three kinds of power, to wit: horse power, *stationary* steam power, and *locomotive* steam power.

Aside from the extra expense of transportation, arising from the cost and repairs of the inclined planes, the expense of sustaining these several kinds of power on so short a road, must obviously very much increase the expense over a level road. The locomotive engines used upon this road *were not the most efficient of their class*, and in point of power and useful effect, were inferior to others which were in use at the time the report alluded to was written; yet no allowance was made, and nothing said as to anticipated or probable improvements, which have since been very great.

It seemed not to have been considered, likewise, that the extreme shortness of the road would make a difference in the cost of transportation,—that it required about the same number of horses and engines, the same expense and delay of loading and unloading, as for a much longer distance, and that the number of agents, superintendents, laborers, &c., necessary to conduct the transportation, would not be materially increased by adding to the length of the road, and likewise, that the freighting business, on that road, had previously been quite limited, and the arrangements for receiving and discharging freight at the two extremes of the road, were then, and still are, in a very incomplete state. Notwithstanding this, it is stated in the report under consideration, that the cost of transportation upon the Mohawk and Hudson Road, is not materially greater than it would be on a level road of the same extent, for the sole and *very profound reason*, that "all the ascent for the greatest trade (being as 3 to 1) is overcome by *one* stationary engine,"—and the price, 3½ cents per ton per mile, on that road, is taken as the "*settled*" price of transportation on all level roads, no matter what their length—the amount of business upon them—the facilities for loading and unloading — economising, motive power, &c. &c.,—all these are of no consequence; and this opinion is given in the face of their own statements and conclusions, that the cost on the Baltimore and Ohio Railroad, reduced to a level, was but $3\frac{5}{100}$ cents per ton per mile.

As it regards the cost of transportation upon railroads, Mr. Knight, the Chief Engineer upon the Baltimore and Ohio Railroad, who possesses the superior qualifications of being a man of science, and whose connection with the business concerns of that road, enables him to speak understandingly as to the result of past experiments, estimates the rate of transportation on that road, when continued west to the Ohio River, with occasional acclivities of 50 to 100 feet per mile, at less (on the average) than *one and a half* cents per ton per mile. Reducing this to the cost on a *level* road, on the *principle* adopted in the report, and we shall have the *actual* cost derived, from the *best* "*experience*," at about 1½ *cents* per ton per mile.*

In confirmation of this we may state, that the transportation, for the past year, on the Ithaca and Owego Railroad, between the inclined plane and Owego, has averaged, if any thing, less than the amount last stated, although this part of the road is far from level, and one-half of it is still in an imperfect or incomplete state; and, moreover, that the total cost of passing the inclined plane has equalled that upon the remainder of the road. This road, we should not omit to state, is destitute of the *questionable advantage* of an "*ascending plane in the direction of the heavier trade*," which upon the Mohawk and Hudson Road appears to constiute so *favorable a feature* in the judgment of the authors of the report.

From the preceding, the public will judge as to the soundness of the views taken in the report referred to, of Messrs. Jervis, Hutchinson, and Mills, and of the degree of confidence to be placed in the opinions which are therein advanced.

We have some further remarks to offer in relation to that document, and two or three others, that have emanated from the same source, which we shall give to the public from time to time, as opportunity presents, and as the public interest shall seem to require.

OSWEGO.

* A late report shows it under one cent per ton per mile.

For the Railroad Journal.

STRICTURES ON THE REPORTS OF THE STATE ENGINEERS.

No. II.

In the Report of John B. Jervis, Holmes Hutchinson, and Frederick C. Mills, on the relative merits and cost of Railroads and Canals, Doc. 296, of the last Session of the New-York Legislature, p. 33, is the following:

"The cost (meaning the cost of transportation, exclusive of profit and toll,) has been shown to be 3½ cents per ton per mile on a level; and as Railroads are not often entirely level, it has been thought proper to a full understanding of the subject, to present a statement, showing the comparative economy in motive power by locomotive steam engines on Roads of different inclinations. In the calculations the engine is assumed to weigh 6½ tons (13,000 lbs.)," &c. "The load carried is exclusive of the tender, and includes freight and wagons."

	Feet per mile.	Tons
"On a level the gross load will be		75·25
On a road or section having an ascent of	10	49·53
" " " " " " "	20	37·35
" " " " " " "	30	27·24
" " " " " " "	40	20·22
" " " " " " "	50	17·04
" " " " " " "	60	13·92
" " " " " " "	70	11·31"

The fallacy of the first statement quoted above, as to the cost of transportation upon Railroads, was fully exposed in the prece-

ding number. We clearly proved, as we trust, to the satisfaction of our readers, that no reliance was to be placed upon the conclusions therein stated, as they were not based either upon facts as they existed, or deductions made upon principles of sound reason—but "in derogation of both."

We now invite attention to the latter part of the paragraph quoted above, in which a statement is presented of the relative effect produced by locomotive steam power upon level and inclined roads. This statement is faulty, inasmuch as the gross load on a level is rated too low.

The loads upon the several inclinations are likewise rated too low, and they are not properly proportioned to their respective inclinations.

The year preceding that on which the above report was written, was marked by very great improvements in the locomotive steam engine. These improvements were principally made under the patronage of the Baltimore and Ohio Railroad Company, and will be found described in the Railroad Journal of Nov. 29, 1834, three months previous to the time when the report under consideration was presented to the public. Several new engines were constructed in that year on an improved plan. The one called the *Arabian* was deemed the most perfect, and weighed (including fuel and water in boiler) 7½ tons, being a little heavier than the engine assumed in the report. The Arabian "ran 50 days between Balti- "more and the Parr Ridge, a distance of 82 "miles daily, making 4,100 miles without "requiring repairs, or showing any per- "ceptible deterioration," and "conveyed, "at the rate of $11\frac{70}{100}$ miles per hour, on a "level part of the road, a train weighing, "including cars, but *excluding* the weight "of engine and tender, 112⅞ tons." "More- "over, this engine advanced with this load, "at one half the above speed, up an ascent "of 17 feet per mile, extending ⅘ths of a mile, "and curved with a radius rather less than "1,000 feet'—which, upon a straight road, would not be less than equivalent to an inclination of 25 feet per mile.

Comparing the performance of this engine with the exhibit of the State Engineers above given, and we find a very great and striking difference. They assume for the gross load conveyed upon a level *only* 75·25 *tons*, whereas, in the instance above stated, the Arabian engine actually conveyed 112⅞ *tons*, being an excess over their estimate of 50 *per cent*. One item they have omitted, viz. the speed or velocity. This omission is the more surprising, as the item is an important and essential one, and whatever it was assumed to be, could not probably have exceeded 14 miles per hour, the rate at which the 112⅞ tons was conveyed by the Arabian. Again, the load which is estimated in the Report as adapted to an inclination of 25 feet per mile, is but 33 tons, whereas the gross load conveyed by the Arabian up an inclination equivalent to that, is 112⅞ tons. This, it is true, was conveyed at a diminished speed; but making all due allowance on this account, and there remains an immense disparity in the actual performance of the Arabian, over and above the amount assumed in the Report. For an inclination of 70 feet per mile, the gross load given in the Report is only 11⅓ tons, while an equal load was conveyed by the Arabian, upon the inclined plane of the Parr Ridge, a distance of ⅘ths of a mile, at the average rate of 10 miles per hour, the ascent being 264 feet, nearly *quadruple* the elevation assumed in the Report for producing the same effect.

We have been thus particular in bringing into the comparison the performances on the Baltimore and Ohio Railroad, as those performances were the result of improvements made the year preceding that on which the Report of the State Engineers was rendered.* There could, therefore, have been no excuse for not refering to them, and the circumstance of their not being noticed is the more strange, as their bearing upon the subject upon which they were giving a professional opinion, was all important to its full and correct elucidation.

The improvements on the Baltimore and Ohio Road were not only not referred to or described, but the public were not even apprised, through the medium of the report, that any had been made, or that there was even probability of farther improvement. It would seem, likewise, that the system of locomotion upon Railroads had attained, in the imperfect condition in which it was exhibited in the report, the last degree of perfection of which it was susceptible.

Admitting that the improvements mentioned had been fully and fairly described as they existed at the time the report was written, which they were not, still it was incumbent upon the writers of the report to have stated that Railroads were in their infancy—that improvements in locomotion for the last ten years had far exceeded those of any equal period in the history of man—that Railroads, as a general means of intercommunication, had sprung into existence within that period—that scarcely one half that time had elapsed since locomotive steam power had been applied with success—that it would, therefore, have been unsafe to assume that further improvements were not to be expected, and that the ingenuity of mankind, now in the full tide of its greatest success, was not to produce results still more important and surprising. A statement similar to this was not only due to the inventive character and spirit of the age, but it was particularly required in reference to Railroads, where the object was to exhibit their permanent and ultimate advantages and disadvantages, compared with Canals, the range for future improvements upon which, from causes which it is not necessary to explain, are comparatively limited.

That we are correct in this opinion, the year which has just elapsed conclusively shows. Chief Engineer Knight, in his last report on the Baltimore and Ohio Railroad, (see Railroad Journal, vol. 4, p. 773,) states that the engines built for that Road within the past year, "have come forth with a power of steam and traction hitherto unequalled, weight for weight, in the operations of the locomotive steam engine." The George Washington engine, weighing 8¼ tons, ascended 5 consecutive miles, the inclination being 20 feet per mile, at the rate of 11½ miles per hour, with a gross load of 113 tons—being *treble* the load allowed upon the same inclination in the report under consideration, and equivalent to a gross load on a level of 211 tons, moving with the same velocity, which is likewise *treble* the load presented in the report, for a level road.

This latter comparison is made to show that improvements *are going forward* in the department of locomotion upon Railroads, of which fact there is no intimation in the report. The very great contrast between the actual state of those improvements at the time the report was made, and for months previous, as compared with the statements therein given, has been fully set forth.

It illustrates clearly the fact that the authors of the report were ignorant of the subject on which they undertook professionally to enlighten the public, or that they intentionally refrained from communicating the whole truth, and to one or other horn of the dilemma they are inevitably driven.

It may be asked why we have turned aside to examine at all into the merits of this report. We reply that we have done so for two reasons. The report was brought to light under the wing of the Canal Commissioners, as a public document. The character of our State, and of the profession to which we belong, is, therefore, to a certain extent, implicated. It was ushered into being, likewise, when the advocates of a great State and National work were earnestly urging their claims for aid upon the Legislature, and whether so intended or not, its influence in respect to that project was exceedingly prejudicial.

Now that our Legislature are again called to act upon the same subject, we are desirous that the character of this report should be exhibited in its true light, and we have no fears but that when thus stripped it will be completely divested of its power of doing harm.

We must defer, to another opportunity, the illustrations which we intended to give of the disproportion of the loads to the different inclinations, as exhibited in the report. We will now only say, that we

* We might have referred to the important improvements in the locomotive engine, made in Philadelphia the year previous—but the single example adduced is sufficient for our purpose.

shall prove that the estimates on this head were empirical, and could not have proceeded from any calculations based upon accurate scientific principles.

OWEGO.

WILMINGTON AND RALEIGH RAILROAD.

Meeting of Stockholders.

Pursuant to public notice, the Stockholders in the Wilmington and Raleigh Railroad, met at the Court House in Wilmington, N. C., on the 14th March, 1836, and were organized by the appointment of Wm. D. Mosely, Esq., as Chairman, and Gen. James Owen as Secretary.

After the objects of the meeting were explained, the following proceedings took place.

On motion, Resolved, That Gen. E. B. Dudley, Gen. Alex'r MacRae, and James S. Green, Esq., be a committee to examine such proxies as may be presented. This committee reported that 1296 shares are represented by proxy,* and 3360 by individual stockholders.

Resolved, That the salary of the President of this Company be fixed at $2000 per annum.

Resolved, That the offices of Secretary and Treasurer be filled by the same person, during the present year, at a salary of $1000 per annum.

Mr. Lazarus, Chairman of the Commissioners, submitted their report, which was accepted.

The meeting proceeded to elect a President and ten Directors. A ballot being had, Gen. E. B. Dudley was elected President, and Andrew Joyner, W. D. Mosely, James S. Battle, A. Lazarus, A. Anderson, Wm. B. Meares, P. K. Dickinson, James Owen, R. H. Cowan, and Thomas H. Wright, Directors.

Whereas, subscriptions to the capital stock of this road have been made along the contemplated route, as well as at Wilmington—therefore,

Resolved, That the President and Directors be authorized to have the road commenced both at Wilmington and Halifax, due regard being had to the amount subscribed north and south of Contentnea creek; and that the President and Directors be instructed to commence the work with as little delay as possible.

Resolved, That the President and Directors be hereby directed to cause the road to be located on the most eligible route from this place to Halifax.

Resolved, That a general meeting of the stockholders shall be held in this place on the first Monday in November next, and thereafter, annually, on the first Monday in May.

Adjourned to 10 o'clock to-morrow.

TUESDAY, March 15.

Stockholders met at the Town Hall.

Resolved, That the President and Directors be authorised to re-open the books of subscription, at such times and places as they may deem expedient, and under the superintendence of Commissioners, to be appointed by them, for an amount of stock not exceeding 2,000 shares.

Resolved, That a Committee of three be appointed by the Chair, to draft and present, for the consideration of the Stockholders, at their next general meeting, a code of Bye-Laws for the regulation and government of the Company.

Whereupon, W. B. Meares, A. Lazarus, and A. Anderson, were appointed said Committee.

On motion of Gen. Blount,

Resolved, That the Engineer be instructed to examine a route touching at or near the town of Waynesborough, on Neuse River, and thence at or near Rocky Mount, the great Falls of Tar River, and report thereon to the President and Directors—[this resolution amended on motion of Gen. A. Mac Rae]—and also by Duplin Courthouse, Rockford on Neuse, and Tarborough, and such other routes as may be suggested or approved by the President and Directors.

Resolved, That the thanks of the Stockholders be tendered to the Chairman of the Commissioners, and the Chairman and Secretary of this meeting, for the zealous and able discharge of their respective duties.

The meeting adjourned, to meet in this place on the first Monday in November next.

W. D. MOSELY, Chairman.
JAMES OWEN, Secretary.

Immediately after the adjournment of the meeting of Stockholders, the Directors met, and appointed Gen. ALEXANDER MAC RAE Superintendent of the Railroad, and JAMES S. GREEN, Esq., as Secretary and Treasurer. They also instructed their President to engage the services of WALTER GWYNN, Esq., as their Principal Engineer; and in pursuance of authority given by the Stockholders, have determined forthwith to re-open books of subscription for an amount not exceeding 2,000 shares.

The services of Major GWYNN have been engaged, and the survey will be commenced immediately.

*The proxies were, Hon. Wm. D. Mosely, representing the Lenoir stock; Robert Soutter, Esq., the Norfolk do.; Gen. Blount, of Nashville, the Nash and Edgecombe do.; Dr. Andrews and Mr. Lane, of Waynesboro', the Wayne do.; and Gen. Alex'r Mac Rae, the Edgecombe do.

RAILROAD AND CANAL INTELLIGENCE.

UPPER CANADA.

The Toronto and Lake Huron Railroad bill has passed the Assembly by a large majority, and will, we have no doubt, receive the sanction of the other branches of the Legislature. 35,000*l.* have also been voted, by resolution, for the continuance of the macadamization of Yonge street and of Lot street, east and west of this city; 15,000*l.* to be expended on Yonge street, 10,000*l.* on Lot street, east, and 10,000*l.* on Lot street, west. His Majesty's Receiver General will be authorised to borrow this amount, on the credit of the tolls derivable from the roads, and in case of deficiency, on the general credit of the District.—[Correspondent and Advocate.]

MASSACHUSETTS.

A Railroad from Providence to Woonsocket Falls is proposed.

A very favorable opinion is held of the usefulness of this route, and its relation to the proposed Worcester and Hudson, a "Great Western Railroad."

NEW-JERSEY.

Elizabethtown and Somerville Railroad.—A public meeting of the friends of this road is advertised in the Somerville papers for Saturday next, at 3 o'clock, P. M. We are told that the Board of Directors have resolved to complete the whole road from Elizabethtown to Somerville, during the present year, and have already appointed an agent, who is now contracting for the railing and other materials, necessary for the prosecution of the work. It is in the contemplation of the friends of this enterprise to extend the road from Somerville to Belvidere, and Easton, Pa., and thence to connect with the N. Y. and Erie Railroad.

The Elizabethtown Journal is authorised to say that the section of the road from that place to the Point, will be completed by the 4th of July next.

The city council of Trenton, alive to the interests of their fellow-citizens, and aware of the great importance of a direct communication, by means of a railroad, with the city of New-York, at a recent meeting, appointed a committee of three on their part, to address the Camden and Amboy Railroad, and Delaware and Raritan Canal Companies, and request them to make their lateral road through that city, subject to the ordinances to be hereafter passed concerning railroads.

MARYLAND.

An account of the surprising performance of the locomotive on the plains of the Baltimore and Ohio Railroad, will be found in another column.

NORTH CAROLINA.

Wilmington and Halifax Railroad.—At a meeting of the Subscribers to the Wilmington and Halifax Railroad, held in the town of Wilmington, N. C., on the 14th and 15th inst., the company was organized by the appointment of

GEN. EDWARD B. DUDLEY, *President.*

ANDREW JOYNER,
WM. D. MOSELEY,
JAMES S. BATTLE,
A. LAZARUS,
A. ANDERSON,
W. B. MEARES,
P. K. DICKENSON,
R. H. COWAN,
T. H. WRIGHT,
JAMES OWEN,
} *Directors.*

WALTER GWYNN, *Engineer.*

It is intended that the road shall be commenced at Wilmington and Halifax at the same time, regard being had to the amount of subscriptions at each end. As soon as the survey is completed, the work is to be prosecuted without delay.

OHIO.

Cleveland and Warren Railroad.—In the (Cleveland) Daily Herald of the 15th inst., we find the report of Col. S. Dodge, on the survey of this route.

From this we find that the ground in general offers unusual facilities in location.

The grades are moderate—no curve less than 2,000 feet radius need be allowed.

The estimate of a road bed, 20 feet wide, with proper slope, and for a double track,

is $364,747 54. Yellow poplar and red cedar are abundant on the lake, and along the line. The rail is to be of wood, protected by bars of iron.

BALTIMORE AND OHIO RAILROAD—LOCOMOTIVE ENGINES.

CITY COUNCIL—FIRST BRANCH.

Wednesday, March 24th.

Mr. Barnes, from the Joint Committee appointed to witness experiments upon the power of the Locomotive Engines, at the inclined planes, submitted the following report:

The Joint Committee of the City Council of Baltimore, appointed to witness experiments upon the power of the Locomotive Engines, on the Baltimore and Ohio Railroad, at the inclined planes, respectfully report:

That your Committee left Baltimore on the morning of Tuesday last, accompanied by a committee of the Board of Directors of the Company, a committee of the Board of Trade, and other individuals, in all amounting to 42 persons. The train consisted, besides the engine and its tender, of a double 8 wheeled passenger car, constructed to accommodate 44 persons, and 3 four wheeled passenger cars, capable of containing 17each. After some delay, occasioned by coming in contact with the leaders of a burden team, who being alarmed, sprung before the engine from off the adjoining track, the train arrived at the foot of plane number 1, at the distance of 42 milts from Baltimore. The instructions given to the engineer had been, as your committee are informed, to stop here, and, disengaging the double car, to attach the three single cars to the engine, and to ascend the planes with them, and with 50 passengers, this being a demonstration of the power of the engine, which, it was believed, would satisfactorily prove its efficiency for use, where the elevation was at the rate of 200 feet per mile. Confident, however, in the power of the engine, the engineer, without stopping at the foot of the plane, commenced its ascent, with the train that had left Baltimore. The impetus acquired on the level, was lost in the first 300 feet of the ascent, after which, the engine drew its load steadily to the summit of the first plane, at the rate of from four to five miles an hour, accumulating speed as it approached the top. This plane is 2150 feet in length; 2050 feet of which ascend at the rate of 197 feet per mile, and 100 feet at the rate of 201 feet per mile. From the first plane the train proceeded to the second, which is 3000 feet in length; 2800 feet of which ascend at the rate of 170 feet per mile, 100 feet at the rate of 227 feet per mile, and 100 feet at the summit, at the rate of 264 feet per mile. The engine and its train ascended at the rate of from 5 to 6 miles per hour, to within thirty feet of the summit of this plane, when, while on the grade of 264 feet to the mile, it stopped. The three small cars, weighing 5 ton 100 weight, were then cast loose, when the engine starting, without assistance, on this grade, drew the double car and passengers to the summit with the greatest apparent ease. The steam escaped in volumes from the safety-valve, as well when the engine reached the summit of the planes, as when it left the foot of them. The weight drawn up the planes was as follows, according to actual weighing:

Paterson,	1.	10.	2.	0.
Patapsco,	1.	15.	2.	0.
Carroll,	1.	15.	2.	0.
Double Car,	4.	17.	0.	0.
45 Passengers,	8.	0.	0.	0.
Tender,	4.	7.	0.	0.
Tons,	17.	5.	0.	0.
Engine,	8.	10.	0.	0.
Making a gross weight of	25.	15.	0.	0.

This weigh: of 25 tons 15 cwt. was drawn up the grades before mentioned, the steepest of which was 227 feet per mile, with much ease, and by the inherent power of the engine, without the assistance of the impetus of previous high speed—and the weight of 20 ton 15 cwt., deducting from the above the weight of the three cars cast off on plane number 2, was drawn with equal ease up a grade of 264 feet to the mile,—the engine starting the train from rest on this grade. At the summit, two car loads of pig iron, weighing each 4 tons, were attached to the train, and the whole, weighing then 33 tons 15 cwt., was made to descend the plane, on the return to Baltimore, by the action of the engine alone, and without the assistance of a brake, at such speed as the engineer pleased, and was several times stopped, on the way down, to show the command in which the engine was held.

With such results as the above, it is unnecessary to add, that your committee are equally gratified and surprised; and from what they themselves witnessed, they have no hesitation in expressing their conviction, that the engines of the Baltimore and Ohio Railroad are capable of drawing with ease, at least 50 passengers, up ascents of any length, of from 200 to 220 feet per mile.

From the account thus given, it will be at once seen, that the performances of the best engines in England have been far surpassed; and although your committee are aware, that calculation was competent to prove the practicability of ascending grades like those at the planes, with engines of the weight and power used on this occasion, and with similar loads, yet it was reserved for the company in question to prove that machines of such giant power could be constructed, combining with their great srrength, the important qualities of speed, durability, facility of repair, and capability to use anthracite as their fuel.

Your committee are glad to have an opportunity of expressing their sense of the obligations, which the efforts of the Baltimore and Ohio Railroad Company have conferred upon the railroad system generally, and more especially in reference to it, as connected with the city of Baltimore. It is now a matter of common parlance to assert, that the Alleghanies can be passed by locomotive engines, by the Potomac route, without the use of stationary power; and your committee entertain no doubt of the fact. It is this which gives to Baltimore the vantage ground, in the competition with her sister cities, for the western trade; and yet this is owing, not more to the geographical depressions of the mountain range, than to the engines perfected by the company just named. Excepting the engines manufactured by them, there is probably not one in the United States, although some of the best ever made in England have been imported, which is capable of ascending the grades and passing the curves for any profitable purpose, which must occur among the mountains on the road in question. While nature, therefore, has done much to facilitate the intercourse of Baltimore with the west, the Baltimore and Ohio Railroad Company has not done less.

Your committee make these remarks as an act of justice; and they do it with the more pleasure, because it enables them to bestow a deserved compliment upon the American mechanics, who have so well illustrated their capacity and skill in the manufacture of the Engines in question—proving, satisfactorily, that in this, as well as in the other departments of human industry, their inventive genius is capable of the most elevated and useful flights. It is now but a few years since the universal voice called upon the Baltimore and Ohio Railroad Company to follow the example of their neighbors, and import their engines; and their perseverance in refusing to do so, although founded upon the very best and truest appreciation of circumstances, was stigmatized as folly or obstinacy. The result has fully justified their course, and showed that their confidence in the skill of the artisans of this country to produce a more perfect machine than had yet been manufactured in England, and better adapted to the Road from Baltimore to the Ohio, was fully warranted.

The capacity of a locomotive engine, when employed in heavy drafts, depends upon three things:—1st. Its weight, which gives it the adhesion on the rails that is requisite.—2d. The capacity of its cylinders to use the adhesion to its utmost limit.—3d. The ability of the boiler to supply the cylinders with steam equal to their capacity. Where the power is applied to but one pair of wheels but half the adhesion is used, supposing the weight to rest equally on the four wheels. Where the power is applied to both pair, the weight of the whole engine is made effective to produce adhesion. The English engines generally have but one pair of wheels geered. The engines of the Baltimore and Ohio Railroad Company have both pair geered. The weight of the engines, therefore, being equal, and there being enough steam to overcome the adhesion of both pair of wheels, the Baltimore engine must be double the effective power of the English engine. The larger the cylinders, in stroke and in diameter, there being steam enough to supply them, the greater the power they afford—and the cylinders of the Baltimore engines being twelve and a half inches in diameter, and twenty-two inches stroke, while the English engines rarely exceed ten or eleven inches in diameter, by seventeen or eighteen inches stroke, the former are, of course, the most effective, since the daily experience of the Baltimore and Ohio Railroad Company shows the ample supply of steam, which the peculiar construction of the boiler affords at all times. At the end of 9 months of constant use, the tubes of the Baltimore boiler have been found on examination as perfect as when they were inserted, while in the English engine, the renewal of tubes is a constant source of expense and vexation. The number of tubes in the Baltimore engine is four hundred, while in the English engine it rarely exceeds 120, causing a proportionate difference in the fire surface, or capacity for generating steam, the heat applied in the furnace being the same.

Your Committee state these facts, which are of easy comprehension, to show that the superiority of the Baltimore engine over the English one of the same weight, is not a matter of accident only, or about which there can be any mistake, but an inevitable consequence of well known philosophical and mechanical principles.

The engines of the Baltimore and Ohio Railroad Company are manufactured by Messrs. Gillingham and Winans, at the

Company's shops. Both of these gentlemen were, for many years, in the service of the Company, in the Department of machinery, before they became contractors; and to them, together with the late PHINEAS DAVIS, the former contractor, is to be attributed the perfection of the present locomotive. Their establishment is a large one, employing upwards of an hundred workmen, and of itself is of great benefit through the employment that it gives, and the money which, necessarily, it is the means of circulating. The Company has a prior claim to the services of the contractors, paying a stipulative price for the engines, ($5000,) and the machinery which are obtained from them, and paying for repairs by the time which they consume. The expenses of the shops are borne by the contractors, who build and manufacture for others as well as the Company. The shops and permanent machinery have cost the Company about $10,000,—which sum has been already returned to it in the reduced price for which the contractors build the engines, in consideration of the advantages of the use of the shops, the proximity to the road, and the opportunities of working for other companies.

In the annual report of the Baltimore and Ohio Railroad Company, the power of their engines has frequently been mentioned, and the authority and character of these reports have been quite sufficient to authenticate the facts therein stated. Your Committee are aware, however, that the incredulous as to the ascent of the plains at Parr's Spring Ridge, have not been few, and, perhaps, the very importance of the results stated, so far exceeding all previous experience, has been the cause of doubt; or in other words, "the news was held to be too good to be true." Your Committee, however, are witnesses, with many others, to the surprising efforts and efficiency of the engines in question, and they are glad that an opportunity has been afforded them to add their testimony in corroboration of that which reflects so much credit upon the mechanics of our country, and to express their approbation of the persevering and patriotic individuals who, in the management of the Baltimore and Ohio Railroad, have called our native talent into play, and done so much to develope and increase the efficiency of the Railroad system.

All of which is respectfully submitted.

SAMUEL BARNES, WALTER BALL, SAMUEL HARKER, J. B. SEIDENSTRICKER, JOSHUA DRYDEN, JOHN SCOTT, HENRY MYERS,	Committee of the First Branch.
WILLIAM REANEY, SAMUEL READY, JAMES FRAZIER, F. LUCAS, Jr.	Committee of the Second Branch.

REPORT OF THE CANAL BOARD, UNDER THE ACT PASSED MAY 11, 1835, IN RELATION TO THE ENLARGEMENT OF THE ERIE CANAL.

To the Legislature of the State of New-York:

The Canal Board, under the act entitled "An act in relation to the Erie Canal," passed May 11, 1835, respectfully submit the following

REPORT:

The first section of this act authorizes and directs the Canal Commissioners to enlarge and improve the Erie Canal, and construct a double set of lift locks, as soon as the Canal Board may be of the opinion that the public interest requires such improvement.

By the second section the dimensions to which the Canal and locks shall be enlarged, are to be determined by the Canal Board; and the third section authorizes an independent Canal to be constructed in passing cities and villages, and at other places, instead of enlarging the present works, if the Canal Board shall decide that the public interest will be thereby promoted.

The first meeting of the Canal Board under said act was held at the Canal Room in the Comptroller's office, in the city of Albany, on the 20th day of June last. On the third day of July the Board adopted the following resolutions:

1. *Resolved*, That the public interest requires the enlargement and improvement of the Erie Canal, and the construction of a double set of lift locks therein.

2. *Resolved*, That the doubling of the locks, and the works connected therewith, ought to be commenced without delay, and prosecuted with all reasonable diligence, beginning with that portion of the Canal between the village of Syracuse and the city of Albany.

3. *Resolved*, Pursuant to the 10th section of said act, that the enlargement of the Canal should be commenced immediately after a sufficient sum shall have been collected and invested from the Canal revenues, to discharge the Erie and Champlain Canal Debt.

4. *Resolved*, That the Canal Commissioners proceed without delay to make surveys for all the improvements contemplated by the said act, and that they make the necessary appropriation of all lands, waters, and streams for the purpose aforesaid.

5. *Resolved*, That the Canal be enlarged so as to give six feet depth of water, and in general sixty feet width of water on the surface, with a slope of two feet to one in the banks.

6. *Resolved*, That the locks be enlarged so as to be one hundred and five feet long between the quoin posts, and fifteen feet wide in the clear, and in other respects be adapted to the enlarged Canal.

7. *Resolved*, That the aqueducts be constructed, so as to give at least forty feet water way, except that the Rochester aqueduct may, in the discretion of the Canal Commissioners, be constructed with a water-way not less than thirty-six feet wide.

8. *Resolved*, That in other respects than those provided for by the foregoing resolutions, the Canal Commissioners make such improvements in the Canal and the works connected with the same, as they shall deem expedient.

9. *Resolved*, That the Canal Commissioners be requested to cause such examinations and estimates to be made as the time will permit, for the purpose of ascertaining the practicability and probable expense of an enlargement of the Canal, so as to give the several sizes of six and seven feet depth of water: the width at surface to be in general ten times the depth of water.

10. *Resolved*, That the Board, when it adjourns, will adjourn to meet at this place on Tuesday, the 20th day of October next, to hear the report of the engineers, and consider further of this subject.

On the 6th day of July the Board of Canal Commissioners at a meeting held in the city of Albany adopted the following resolutions:

Resolved, That, for the purpose of making the survey of the improvement of the Erie Canal as contemplated by a resolution of the Canal Board of the 3d inst., said survey shall be commenced at the following places: at the city of Albany, and proceed west; at the upper lock in the village of Frankfort, and proceed east; at the upper lock in the village of Frankfort, and proceed west; and at Buffalo and proceed east.

Resolved, That the charge of the survey commencing at Albany and proceeding west, is confided to the charge of John B. Jervis: That the charge of the survey commencing at Frankfort and proceeding east, is confided to Nathan S. Roberts: That the charge of the survey commencing at Frankfort and proceeding west, is confided to Frederick C. Mills, and that the survey commencing at Buffalo and proceeding east, is confided to Holmes Hutchinson. Each of whom is hereby appointed and designated as the engineer for the purpose aforesaid.

At a meeting of the Board of Canal Commissioners, held at Utica on the 17th day of July, the following regulations were adopted in reference to the surveys of the Erie Canal, with a view to its enlargement.

1st. The surveys shall be of such a description as will enable the engineers to report the probable comparative expense and opposing obstacles of enlarging the Canal to 6 feet deep and 60 feet wide, and also 7 feet deep and 70 feet wide: said report to be made by the 20th of October next, or at an earlier day if practicable.

2d. At all difficult and expensive points, such as the perpendicular bluff of rocks east of the three locks below Schenectady, at Flint Hill, at the bluff of rocks below the two locks at Philip's, at Yankee Hill, at the bluff above Fultonville, at the little and big nose, at Dieffendorf's hill, at the Little Falls opposite Herkimer, at the Cayuga marshes, at the Irondequoit, Sandy creek, Otter creek, and Fish creek embankments, and from Lockport to Buffalo the width may be limited to 50 feet.

3d. The quantity of water to be appropriated shall be sufficient to supply the maximum amount of business which can be done on the enlarged Canal, calculating 150 cubic feet per minute per mile for the eastern section, and 100 cubic feet per minute per mile on the middle and western sections, for a Canal of the dimensions of the present Erie Canal, to which is to be added the lockage water.

4th. The survey shall be made in reference to a feeder from the Mohawk river, at the four locks above the Cohoes, at the upper aqueduct; at some convenient point between Schenectady and Fort Plain, at the Minden dam; from the Palatine creek, at the Little Falls on the south side of the river, and also on the north side.

ROME SUMMIT.

A feeder from the Mohawk river, from the Black river, and Fish creek, and the Canaseraga creek.

JORDAN SUMMIT.

To report on the expediency of making a reservoir of the Skaneateles lake, either by raising the water or cutting down the outlet, and also of making a reservoir of the Owasco Lake and a feeder from the Owasco creek.

A feeder from the Genesee river and the Tonawanta and Oak Orchard creeks.

5th. The Engineers shall furnish themselves with convenient transcripts of the map made by Holmes Hutchinson under the statute directing the survey of the Canals: designating thereon the exterior bounds of the survey made by Mr. Hutchinson for doubling the locks.

6th. A berm shall be formed at all places except where deep rock excavations occur, and the drainage water shall be conducted under the Canal by culverts, or into it by regular sluices, formed for that purpose with a cess pool outside the bounds of the Canal to receive the deposit.

7th. The banks to be raised 3 feet above the surface of water on the inner edge, and 2 feet on the outer edge, and the towing path bank to be 12 feet wide on the top, with slopes on each side of two feet horizontal base to every foot rise; and the berm bank is to be 8 feet wide on the top with the same slopes.

8th. In cities and villages where the Canal cannot be widened to the required width without removing buildings at a great expense, examinations shall be made for a separate Canal.

9th. As far as practicable the pound reaches between the locks shall be so large that two lockages of water shall not depress the surface more than six inches.

10th. The engineers are requested to report plans for bridges having a water way of 50 and 60 feet under them.

11th. To examine and report on the question how far the new lock can be most conveniently located from the present lock, in reference to the convenience of navigation.

12th. To report on the expediency of making the towing path of sufficient width to enable two horses to tow abreast.

13th. To report such suggestions as may occur to them, in reference to the duties submitted to their charge.

14th. To report an opinion of the dimensions of a lock best adapted to economy in transportation, in reference to the enlarged canal on either plan.

The engineers completed the surveys, and their reports were submitted to the Canal Board on the 20th day of October, with estimates of the cost of the contemplated improvement on both plans for the enlargement, and of all the feeders and reservoirs directed to be surveyed. These reports and estimates are herewith submitted.

The aggregate of the estimates including the cost of a double set of lift locks on the whole line, is,—

For the largest canal,	$12,416,150 17	per Mile. = $34,204 37
For the smaller canal,	10,368,331 48	= 82,562 90
The difference is	$2,047,818 69	

A little more than 20 per cent.

In presenting this estimate it is proper to remark, that it is not contemplated to construct a double set of lift locks on the enlarged plan, until the business on the canal shall be so increased as to render it necessary, excepting in situations where the present locks require to be rebuilt, or where in making the enlargement the line is so changed as to render the present locks useless.

These estimates include the expense of removing buildings from the line, but nothing for damages.

The estimate from Utica to Lyons, is not confined to the expense of the enlargement and the necessary additional feeders, but includes the cost of rebuilding nearly all the aqueducts, and some of the culverts and bridges, on account of their decayed condition, and of all the additional feeders and reservoirs which have been surveyed. East of Utica the estimates include the cost of rebuilding the lower aqueduct across the Mohawk river, a portion of the bridges and other mechanical structures; and also of a new line and aqueduct at the Schoharie creek, and a new line at the nine locks.

These improvements to the canal are necessary, even though it were not enlarged. If the amount estimated for this purpose and such part of the expense for feeders and reservoirs as may not be required were deducted, it would reduce the aggregate which has been presented, but how much cannot now readily be determined.

The plans on which the estimates are based, are of the most substantial character, comprising much better and more expensive work than the plans on which the Erie canal was originally constructed. The locks will cost nearly 100 per cent. more.

These estimates were, no doubt, made with all practicable care and correctness; but it is difficult to speak of them with much certainty. Great allowances should be made, on account of the short time allotted for this service, and the difficulty of estimating the value of work, which must be done under circumstances like those attending the improvement in question.

On the basis which was furnished in the directions to the engineers, it is estimated that the enlarged canal will require an additional quantity of 14,546 cubic feet of water per minute for the Rome summit, and 7,990 cubic feet per minute for the Jordan summit. This computation is made on 250 lockages, every twenty-four hours, for the Rome summit, and 220 for the Jordan summit.

The additional feeders and reservoirs which have been surveyed, and which are available to supply these summits, are estimated to furnish as follows:

FOR THE ROME SUMMIT.

From the Black river, cubic feet per M.	14,681
From the Fish creek, cubic feet per M.	13,725
From the Canaseraga creek, cubic feet per M.	327
	28,733

FOR THE JORDAN SUMMIT.

From Skaneateles reservoir, if raised two feet (for 120 days,)	4,840	c.ft.per.M.
The addition by depressing the outlet, 3 feet (for 120 days,)	7,260	do
From the Owasco outlet,	4,800	do
From the Owasco reservoir,	3,549	do
From the Nine Mile creek,	3,000	do
	23,449	

These estimates were made during the past season, when the streams of the country were much above their ordinary minimum flow; but deductions, proper in the opinion of the engineer, were made from the guaged quantity on this account. The examinations show that a much larger quantity of water is available for the Rome and Jordan summits, than the largest canal which has been contemplated will require, for the extent of business which can be done with double locks.

On the western section it is expected that the principal supply for the canal must be drawn from Lake Erie, and it is intended to give the canal such capacity as will render this practicable, without creating a current which may impede the navigation.

The surveys have shown that additional feeders may be taken from the Mohawk river, and there can be no doubt about obtaining a supply for the eastern section.

The Canal Board at their meeting in October, reconsidered the decision made in July, in reference to the extent of the enlargement of the canal and locks.

The Board, after a careful examination of the information derived from the surveys, and the facts submitted to their considera tion, decided that the canal should be en larged to seven feet depth of water, and 70 feet width of surface; and in the present month, they agreed on a lock 110 feet long between the quoin posts, and 18 feet width of chamber.

To decide on the dimensions to which the canal and locks shall be enlarged, has imposed a question of high responsibility, not free from doubt, and about which there is some diversity of opinion.

To change the boundaries of the canal, imposes a delicate interference with private property; and the Canal Board are aware that in fixing on the limits to which the canal should be enlarged, they were deciding a question which should be considered definitely settled. The idea of disturbing the bounds of the canal for a second enlargement cannot be entertained.

The prospective, business, and every consideration connected with this subject, unequivocally indicated, that the enlargement of the canal and locks should be such as would furnish the greatest facilities to busi-

ness, and the cheapest rate of transportation.

The amount of cargo which approaches nearest the maximum that can be transported on a canal, with the greatest economy, experience has no where pointed out with certainty.

The Commissioners here refer to various experiments to determine the relative proportion of the transverse section of a boat and canal, in reference to the power of traction. Such different data have been used in making the calculations, that they disagree materially.

(To be continued.)

Applications of Chemistry to the Useful Arts, being the substance of a Course of Lectures delivered in Columbia College, New-York, by James Renwick, Professor of Natural Experimental Philosophy and Chemistry.

III.

SALTS OF COMMERCE.

1. COMMON SALT.

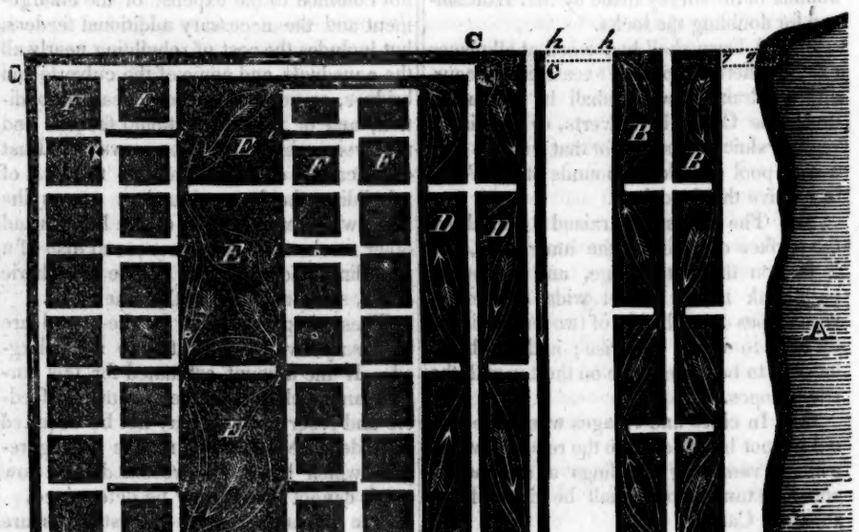
The sources whence common salt, (*chloride of sodium,*) is derived, are, the water of the ocean; salt springs, which are found issuing from certain geological formations; and beds of rock salt. The two former may be separated from the salt they hold in solution, either by spontaneous or by artificial evaporation.

MANUFACTURE OF SALT FROM SEA-WATER BY SPONTANEOUS EVAPORATION.

AUTHORITIES.—FOURCROY. Traite de Chimie.
DUMAS. Chimie appliquee aux arts.

There are some warm and dry climates where, from these favorable circumstances, salt is formed by spontaneous evaporation from natural basins, which have an occasional communication with the sea at the highest state of the tides. From such basins it is only necessary to rake out the salt as it forms from time to time at the surface. In less favorable climates, artificial salt-pans are formed by embanking portions of salt meadow, and dividing the embanked space, by dykes, into a number of basins, into which the water being successively admitted, and caused to expose a large surface, is finally evaporated. The first basin is of considerable size, and serves as a reservoir, receiving water from the ocean at spring tides, and retaining it for use. From this reservoir the salt water is conveyed into the first of a series of rectangular basins, called *beds*, by a tube laid under ground. This tube enters at the corner of the first bed, and is directed by the arrangement of the openings in the separating dykes, diagonally across each of them to the end of the series. From the last bed it is passed by another subterranean tube into an open canal, which is directed in such a manner as nearly to enclose a square. The tube is admitted at one of the angles of this square, and the channel drawn from it around the square until it comes again into a basin, which is separated from the first branch of the canal by a dyke. This basin is the first of a second series, of the same extent as the first series, which go by the name of *tables*. After traversing the tables, the water passes by a short canal into a larger basin, called the *muant*, along two sides of which are arranged a number of smaller ones, in two rows, called the *areas*. These have floors of clay or plaister impervious to water. Canals are formed in such manner that each leads the water from the muant towards the common corner of four of the areas, but is still separated from them by their surrounding dykes. A temporary communication being made with these canals, the water is permitted to flow upon the areas to the depth of about an inch, after which the entrance is stopped. In these areas the salt begins to crystalize at the surface, and as soon as a crust is formed it is broken up, and either finally raked out, or removed after the whole of the water is evaporated to dryness. In the former case the salt is tolerably pure, in the latter it is bitter and disagreeable; nor could it be advantageously disposed of, were it not that the use of it is compelled in countries where salt is a government monopoly. The object of the complex arrangement of canals and basins, as we have described it, is, that when the operation is in regular train, the water, in its passage from the reservoir to the areas where the evaporation is completed, shall expose a large surface to the air, and at the same time have such a degree of motion as may bring it regularly in contact with fresh air. The arrangement of a set of salt pans may be understood from the annexed plate.

PLATE I.



A, reservoir.
BBB, beds.
CCC, canal enclosing a square space.
DDD, tables.
EEE, muant.
FFF, areas.
gg, subterranean communication between the reservoir and the beds.
hh, do. between the beds and canal.
ii, canals, each of which conveys water from the muant to the common angle of four of the areas.

It is proper that the pans should be placed in such manner as to receive most advantageously the currents of the principal winds.

In the north of Europe the use of such salt pans begins early in March, and may continue until the end of September. The water which is first admitted into the areas, remains for eight days before it is completely evaporated. The next charge will take a less time, for the water in the beds, tables, &c., will have been somewhat concentrated; and at the height of the season, the areas may be changed daily.

The salt raked out of the areas is piled on the neighboring ground in pyramidal heaps, where it is permitted to drain, in order to separate the water which adheres, with such matter as it holds in solution, and it attracts water from the air, which dissolves a certain soluble and deliquescent substance which, as we shall see, is contained in sea-water. These heaps are thatched with straw or bushes, in order to prevent the entrance of rain.

The salt manufactured by spontaneous evaporation, even under the most favorable circumstances, is not as pure as some other descriptions, but has the advantage of being formed in regular cubic crystals, which makes it better fitted for keeping meat and curing fish than any other description. Such salt is imported into this country in large quantities from Spain and Portugal, from Turk's Island, and the Cape de Verds. A large natural salt pan also exists within our own territory at Key West.

The impurities of which we have spoken are contained in sea-water, and are but par-

tially separated in the process, or the subsequent draining. In 100 pts. by weight of sea-water, there are dissolved about 3 1-2 of solid matter. This matter, obtained by rapid evaporation to dryness, is composed of

Common salt,	2.54	72.
Chloride of magnesium,	0.35	10.
Sulphate of magnesia,	0.58	16.
Carbonates of lime and magnesia,	.02	00.67
Sulphate of lime,	.01	00.33
	3.50	100.

Of these substances, the carbonates of lime and magnesia being held in solution by excess of acid, will be deposited in warm weather in consequence of the escape of the acid when a large surface is exposed to the air. The sulphate of lime being but sparingly soluble, will, after the few first days of the process, be left behind in the tables, &c., before the water reaches the areas. It will also determine the conversion of a part of the sulphate of magnesia into sulphate of soda; the latter will unite with the sulphate of lime to form a double salt. The remaining sulphate of magnesia, having a solubility in cold water about one half more than that of common salt, but being not much more than one-fifth in quantity, will not begin to crystalize until more than six-sevenths of the water which remains after the salt begins to crystalize is evaporated. Up to this time, then, the salt, if well drained, would be nearly pure. The chloride of magnesium is deliquescent and highly soluble; it will therefore not begin to crystalize until after the sulphate of magnesia, and the discharge of the water that remains after the first appearance of the bitter taste of the sulphate in the salt, will carry off both, except what may adhere mechanically to the crystals. Even if a part of the chloride of magnesium have been formed in the solid state, it may be separated in consequence of its deliquescence, by virtue of which it will attract moisture from the atmosphere, and this moisture will also dissolve some of the sulphate of magnesia. This moisture is separated by permitting the salt to drain.

So far as mechanical impurities adhering to the crystals are concerned, the salt formed in large crystals by spontaneous evaporation, is superior to all others, for it will expose a less surface under equal weight. These impurities, if deliquescent, will be also much more easily removed.

The best salt manufactured in this manner contains 95 per cent. of chloride of sodium, while that made at an unfavorable season has not more than four fifths of its weight of true marine salt, and upwards of 7 per cent. of sulphate of magnesia.

MANUFACTURE OF SALT FROM SEA-WATER BY CONGELATION.

When water holding but little common salt in solution, is exposed to a temperature below freezing, the water is separated into two parts, one of which is nearly pure, and passes into the state of ice, the other remains liquid and retains the whole of the salt in solution. As the temperature decreases, a further separation takes place, until the liquid becomes highly concentrated, and the soluble matter may be obtained at a small expense of fuel by artificial evaporation. This method is used in the northern and eastern parts of Siberia, but the salt obtained is of inferior quality,—although not necessarily so, were the process skillfully conducted.

Note.—Both of the above methods are practicable in the northern and eastern parts of the United States. Our summers and autumns would give us at least six months of weather in which the evaporation by exposure to the sun and air might be successfully practised, and if our spring be less advantageous for the purpose than those of the south of Europe, this is more than compensated by the superior dryness and steadiness of our autumnal climate. Our winters, also, equal in cold those of the same latitude in eastern Asia, and the method of congelation might no doubt be applied to advantage. Salt is manufactured on the shores of Massachusetts Bay, but we are under the impression that the evaporation is performed by artificial heat.

MANUFACTURE OF SALT FROM SEA-WATER BY ARTIFICIAL EVAPORATION.

This manufacture is generally conducted on a small scale, and with little skill, and it is only under peculiar circumstances that it has been profitably pursued. Thus the fishermen of the shores of Scotland are permitted to use salt manufactured on the spot, free from the heavy excise with which it is loaded in other parts of the kingdom. It appears probable that their art consists in little more than evaporating salt water almost to dryness in iron kettles, for the product obtained is extremely impure.

A tolerably pure salt is manufactured in the north of France from sea-water, which has been filtered through sand that has been thrown up by the sea beyond the usual reach of the tides, and which is also within reach of the spray. As the water evaporates from this, it remains charged with various proportions of solid salt. The liquid, after passing through the sand, usually has a density of 1.14, but sometimes as much as 1.17. It is evaporated in leaden vessels, and boiled rapidly over a wood fire. The liquid rises into froth, and must be continually stirred to prevent it from boiling over. The surface is occasionally cooled by throwing on cold brine, in order that a scum which forms may be skimmed off, until the salt begins to crystalize. The evaporation is continued until the whole of the water is driven off, the solid deposit being continually stirred, in order to prevent the lead of the boiler from melting. The salt thus obtained is in fine powder, but is still very impure. In order to separate the soluble impurities, the salt is put into baskets, which are suspended over the boilers while the succeeding evaporation is going on. It is thus exposed to the action of a large quantity of steam, which penetrating between the crystals is condensed, and dissolves the deliquescent impurities along with other soluble matters, and a portion of common salt. The salt is then permitted to drain by placing it on a floor covered with sand, whence the salt has been obtained by filtration. Here it loses about 25 per cent. of its weight by drainage. The salt is then of a fine grain, white color, and agreeable taste.

The coarse or bay-salt, which is formed in large crystals by spontaneous evaporation, is best suited, as has already been stated, for curing meat, in the dry way, and particularly for packing fish. In the latter process, the cavities whence the entrails of the fish have been removed, are filled with the salt, and the barrels are filled with alternate layers of salt and fish. The only solvent is the liquor which exudes from the fish, and it appears that the more slowly this is drawn off by the salt the better. The capillary attraction of fine salt would render this process too rapid. But the salt of Spain and Portugal, and still more of France, although well crystalized, is far from pure. The inhabitants of Holland, therefore, to whom the fisheries are a most important object of national industry, subject the imported bay-salt to a process of purification.

For this purpose, it is dissolved in sea-water, and evaporated at a moderate heat; the evaporation being rendered more slow by covering the large shallow pans of sheet-iron in which it is heated, with planks.

It is to the great care that is taken in the preparation of this salt that the very superior quality of the fish cured by the Dutch is, in a great degree, owing. They also kill and clean the fish the instant it is caught, on which account it is better than that which is permitted to die in consequence of a change of element.

In the curing of meat, also, it cannot be questioned that the method of rubbing and packing in dry salt in large crystals is much to be preferred to steeping in a pickle prepared by dissolving salt.

SALT FROM SALT SPRINGS.

AUTHORITY.—DUMAS. Traite de Chimie.

More attention has been paid to the manufacture of common salt from salt springs, by scientific men, than to any other of the sources whence this article has been obtained. The salts obtained by analysis from several springs are, besides the chloride of sodium, chloride of magnesium, sulphate of magnesia, carbonate of lime, and sometimes carbonate of iron. Together they make up abont 16-1000th parts of the weight of the water of the spring of Moutiers, and are in the following proportions, with the exception of the carbonate of iron, which is deposited as soon as the water is exposed to the air:

Carbonate of lime,	0.05 per ct.	3.125
Sulphate of lime,	0.27	16.875
" of magnesia,	0.06	3.625
" of soda,	0.13	8.125
Chloride of sodium,	1.06	66.25
" of magnesium,	0.03	2.000
	1.60	100

These waters, as well as those of the sea, contain also the iodides and bromides of magnesium.

Rationale.—When the process of boiling this water is followed with attention, it is found that one fourth part of the water has been evaporated and the density increased to 1.14, before the sulphate of lime begins

to be deposited. The deposit then gradually increases until 5-6ths of the water has been evaporated, after which it begins to diminish, and when 17-20ths of the water has been evaporated, ceases altogether. The deposit, when examined, is composed of sulphate of lime and sulphate of soda, in nearly equal proportions, forming in fact a double salt, and nearly as much common salt as of both united. At a density of 1.23, when about 9-10ths of the water has been evaporated, common salt begins to crystalize at the surface, if the action of the fire be moderate; if not, it will also be precipitated. The salt which crystalizes first is nearly pure, but gradually becomes less so, and is finally affected by a bitter taste, arising from the sulphate of magnesia. If the evaporation be stopped as soon as this taste becomes sensible, there remains a thick viscid liquid containing a portion of common salt, along with chloride of magnesium, sulphate of soda, and the iodides and bromides of magnesium. A farther quantity of common salt may be obtained even from this, by the aid of lime. This earth decomposes the chloride of magnesium, and a chloride of calcium results; the latter chloride and sulphate of soda are incompatible, so that a double decomposition results, by which chloride of sodium and sulphate of lime are formed; the greater part of the last of these is precipitated in consequence of its small degree of solubility. By farther evaporation, not only the chloride of sodium thus formed, but a part of that which previously existed, is obtained free from the bitter taste of the sulphate of magnesia, and chloride of magnesium, and from the deliquescent character of the latter. This mode of getting rid of the chloride of magnesium, which is the most injurious both to the taste and value of the salt, might be used to great advantage in all cases, and it is only unfortunate that the chloride does not exist in sufficient quantities to admit of the decomposition of the whole of the remaining sulphate of soda.

Process.—The mode of obtaining salt from the salt springs of the continent of Europe is in strict conformity to the principles deduced from the preceding observations. About 9-10ths of the water, of the density of 1.01, are usually evaporated by exposure to air.

This spontaneous evaporation is performed in three different ways, by that of hurdles; that of tables; and that of cords. The advantages of these are nearly equal, if we have regard to the quantity and quality of the salt, and the rate at which it is crystalized; the only consideration then is their relative cost in different places.

In the first method, hurdles or bundles of twigs of a thorny shrub are piled in open frame buildings covered by a roof. The water is pumped up to the top of these buildings and then distributed in small streams upon the upper course of the bundles of twigs. The direction of these buildings is such that the principal prevailing winds may be at right angles to their length; and the gutters which convey the water are so formed, that it may be distributed in greatest abundance on the windward side. The water having fallen over one series of hurdles, is again pumped up and falls over another series in the same building, until it has descended nine or ten times.

In the method of cords, the water is made to trickle over ropes stretched in a vertical direction from the upper beams of an open frame building to a basin which receives it beneath.

In the method of tables, a number of shallow wooden troughs are arranged in a lofty building. Each of these is inclined sufficiently to allow the water to run gently over its surface, to the lower end, where it passes to the trough beneath, whose inclination is in the opposite direction, and thus in succession till it reaches the bottom.

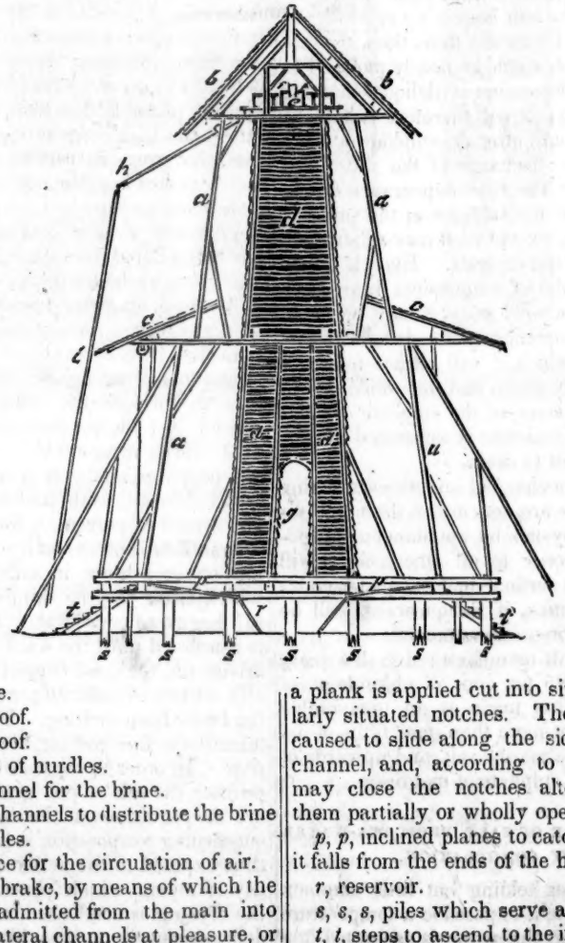
In either of these ways, the water is brought to a density of 1.14; about 9-10ths of its original quantity being evaporated. It is then conducted to large reservoirs, where it deposits the insoluble matters which were mixed with it.

Artificial heat is next employed. The brine, after having become clear, is introduced into boilers made of sheet-iron, and of great size. In some cases, the whole process is completed in one of these. But in the most perfect establishments, two are employed. In the first of these, the water is rapidly boiled and concentrated until the salt begins to crystalize; and during this operation, the greater part of the double sulphate of lime and soda is deposited. As the liquid wastes, more brine is added, which is also freed from this sulphate, and the boiling and addition of brine are continued until the vessel is filled with brine of the density of 1.23. In the next vessel the evaporation is conducted by a gentle heat, the liquid being barely kept at a boiling temperature, and as the salt forms at the surface, it is removed by rakes, until it manifests signs of the presence of the bitter sulphate and chloride. At or previous to this epoch, lime might be added, and the quantity of salt obtained would be increased.

The mother waters, which remain after the salt becomes impure, are set aside, and permitted to stand over a winter, exposed to the influence of frost. At a low temperature the sulphate of magnesia is decomposed by chloride of sodium, and sulphate of soda results. The several substances in the mother water form three successive deposits, of which sulphate of soda is the last, and the only one of any value.

A section of a building containing hurdles, for the purpose of concentrating water holding salt in solution, by spontaneous evaporation, with a part of the machinery, is represented in the annexed plate.

PLATE II.



a, *a*, *a*, frame.
b, *b*, upper roof.
c, *c*, lower roof.
d, *d*, *d*, piles of hurdles.
e, main channel for the brine.
f, *f*, lateral channels to distribute the brine upon the hurdles.
g, open space for the circulation of air.
h, *i*, jointed brake, by means of which the brine may be admitted from the main into either of the lateral channels at pleasure, or distributed in variable proportions in each, according to the direction of the wind. For this purpose, notches are cut on the side of the main channel, and to each side of it a plank is applied cut into similar and similarly situated notches. These planks are caused to slide along the side of the main channel, and, according to their position, may close the notches altogether, leave them partially or wholly open.
p, *p*, inclined planes to catch the brine as it falls from the ends of the hurdles.
r, reservoir.
s, *s*, *s*, piles which serve as foundation.
t, *t*, steps to ascend to the inclined planes.

At one of the European establishments, the spontaneous evaporation is carried farther during the summer months. For this purpose, a building is constructed about

* 18° of Beaume. † 23° of Beaume.

300 feet in length. A number of troughs extend along the upper part of this building, and from holes in their lower surfaces, a number of endless ropes proceed and pass around sleepers at the level of the ground. Beneath these is a reservoir for the brine.

Brine brought, in either of the modes we have mentioned, to the density of 1.14, and then concentrated by boiling to 1.23, is introduced, without being permitted to cool, into the troughs, and thence flows over the cords. It is then pumped back and permitted to flow down a second time; at each passage salt is deposited upon the cords, until the fluid assumes the viscid character of which we have spoken, when it is permitted to escape into the receptacle provided for the mother water. In this way, the crystalization of the salt, which occupies from seven to eight days in the method of slow boiling, may be completed in seventeen or eighteen hours, and the salt is of superior quality. There will form, also, in the reservoir beneath, large white crystals of salt. The cords are about a third of an inch in diameter, and when the thickness of the deposit upon them brings the joint diameter to about 2½ inches, the salt is removed by an instrument contrived for the purpose of breaking it off, and falling into the reservoir beneath, which must, of course, be then empty, may be collected.

When the first part of the process only is conducted by spontaneous evaporation, no more than 9-10ths of the fuel which would be required to boil away the whole of the water, need be used, and by the mode of crystalization upon ropes, even the half of this is saved, so that the saving is 19-20ths of the whole. Whenever, therefore, a cheap power for the purpose of raising the water, in order that it shall perform its several passages over the ropes, hurdles, or tables, can be obtained, the advantages of these methods are enormous. But it would even be a saving to use steam for raising the water; for, the evaporation of a single cubic foot of water in the boiler of a steam engine will raise eighty cubic feet to the necessary height; and the fire which raises the steam may be at the same time concentrating brine, if the boiler be filled with it instead of fresh water.

In the first attempts to make salt from the brine springs in the State of New-York, no other method than artifical evaporation was thought of. This was performed in the iron vessels made for the manufacture of potash. A better boiler was subsequently introduced, in which the smoke and heated air was made to circulate in tubes. The salt obtained in the earlier manufacture was much impaired in quality by the deliquescent chloride of magnesium, and was not free from the bitter taste given by it and the sulphate of magnesia. In this stage of the manufacture, Dr. McNiven was requested to propose a remedy, which he found in adding 1-1000th part of its weight of boiling water to the salt placed in bins, whose bottoms were inclined.—This quantity of boiling water being just sufficient to dissolve the impurities which a careful analysis showed to exist, and the solubility of common salt being but little increased by boiling, the separation was made at the least expense of that substance.

More recently, a method styled that of solar evaporation, has been introduced. In this the salt is placed in shallow pans beneath moveable roofs, by which the sun may be admitted and rain is excluded. It does not, however, appear probable that this method can be as rapid or as economic as those we have mentioned above. It must, in addition, occupy a vast extent of ground.

At the salt-lick on the Kenhaway, in Virginia, the brine is of great strength, 70 gallons of the water yielding a bushel of salt. This is 5 or 6 times as much as is usually furnished by the salt springs of Europe. Coal is also abundant in the immediate vicinity, and can be obtained at a low price. When these springs were first opened,* the waters drawn from a small depth was less rich, and the fuel used was wood. The evaporation was at first rapid, and performed in common potash kettles. To these succeeded shallow pans, first of sheet, and finally of cast iron, which are still employed.

The water drawn from the tubes, which are sunk 80 or 90 feet into the rock, is first exposed for a few days to the sun and air, by which the carbonic acid with which it is charged is dissipated, and the carbonates of lime and iron, held in solution by excess of that acid, are deposited. The clear liquor is then boiled to dryness, and the salt allowed to drain.—The salt thus obtained is of course in fine grains. Salt in large crystals is also made at the same place by heating the brine to a moderate temperature in large shallow pans, by means of tubes in which waste steam from other operations circulates.

ROCK SALT.

Rock salt is sometimes so pure that it may be used without any preparation except crushing. In order that it may be transported as an article of merchandise, it is cut into masses of the figure of a barrel, which are then enclosed in staves and hoops. The lesser pieces are used in the neighborhood of the mines. Such is the quality of the salt from the mines of Wieliczska in Poland, and Cardona in Spain.

In other mines the rock-salt is mixed with earthy matter, whence it must be separated by lixiviation; and that of Cheshire in England contains liquid solutions of deliquescent salts, which make it necessary to dissolve and re-crystalize For the solution of the rock-salt in Cheshire the waters of salt springs which issue from the same formation are employed, or the rock-salt is carried to Liverpool, where it is dissolved in sea-water. In either of these ways the evaporation, which is always by artificial heat, may be performed at the least possible expense of fuel. The process is conducted with great skill, as is evident from the great purity of the salt it produces, which is more free from other saline matter than any other which is an article of commerce. Of this salt there are two varieties: one in small grains, (blown salt,) and of great whiteness, the other in cubic crystals, (ground salt.) The latter, however, is less perfect in form, and the crystals of less size than are obtained by spontaneous evaporation, hence it is of less value for curing fish, or for packing meat in the dry way.

Blown or stoved salt is made in Liverpool by the rapid evaporation of the solution of the rock salt of Cheshire in the tide waters of the Mersey, in large shallow pans of sheet iron. The original boiling point of the solution is 236° Fahr. The salt, as it forms, is drawn out and put into large baskets of a conical figure. After these have been permitted to drain for a time, they are placed in a stove and dried.

The coarse or ground salt is prepared by heating the solution only to 170°, at which it is kept until the evaporation is completed.

A variety, in still larger crystals, is manufactured for the use of the fisheries by evaporating at the constant temperature of 100°.*

In all the three cases the process ceases when the solution becomes viscid; the remainder is rejected under the name of *bittern*.

* See Henry, on Salt.

To be continued.

* See Silliman's Journal for 1834.

AGRICULTURE, &c.

It is a matter of wonder that so little is said and done with respect to breed in so important an animal. We think any thing which throws light on so important a subject, will be acceptable to our readers.

From the Baltimore Farmer and Gardener.

THE MULE.

[Copied by request from the American Farmer, Vol. 7, No. 22.]

PRIZE ESSAY.

[The premium of a silver cup, of thirty dollars value, offered by Robert Oliver, Esq., to the author of the best essay on the natural history of the Mule, and its value for the general purposes of agriculture, in comparison with horses, was awarded by a committee appointed by the Trustees of the Maryland Agricultural Society, to the author of the following Essay:]

A DISSERTATION ON THE MULE,

With the view of promoting an improvement in the breed; and of demonstrating the utility of employing him as a substitute for the horse, in the labors of husbandry, canals, &c. By Samuel Wyllys Pomeroy.

"——Opinion is the queen of the world; it gives motion to the springs and direction to the wheels of power."—John Quincy Adams.

"Knowledge is power."—Bacon.

Soon after the accession of Charles III. to the crown of Spain, his subjects were prohibited, by a severe edict, from wearing *flapped hats* and *long cloaks*; which caused an *insurrection* that obliged him to flee from Madrid, after witnessing the massacre of nearly one hundred of his Walloon guards;

and might have terminated in a revolution, but for a speedy revocation of the edict and banishment of his ministers. An eminent writer introduces the history of the occurrence, by observing that "it is easier to conquer half the world than to subdue a single prejudice or error, most nations having a superstitious attachment to those habitudes which they derive from their ancestors, that seemed to come along with them into the world, and with which they were nursed and brought up."

Perhaps it may be deemed by many quite as visionary or absurd, to attempt an introduction of the mule as a substitute for the horse, for the purposes of agriculture and hackney employment, as was the project of the Spanish monarch for compelling his subjects to wear the *French costume*, to the exclusion of one they had been so long accustomed to look upon "as a *distinction* which was the birth-right of every true Spaniard," and, as we may suppose, so congenial to the indolent habits for which that nation had long been proverbial.

It must be acknowledged that there are serious, though I trust in this age of improvement, not insurmountable impediments—for we have to combat not only hereditary prejudices, or, to speak more correctly, such as have proceeded from a deficiency of means and want of knowledge, to develope the valuable properties and to subdue propensities of a contrary character in this hybrid race, but we are met at the threshhold by the same species of pride which the Spaniards manifested in regard to their costume, founded on the enthusiastic, I may almost say superstitious attachment to the horse.

It is believed that a vast portion of our fellow-citizens, and I may with propriety add the people of Great Britain, from whom we have derived some inveterate prejudices, as well as those illustrious examples that have had such a powerful influence in leading our country to the high destinies that await her, do not consider that a *mule*, especially a well bred one, would be in himself and in their view, one of the best formed and most distinguished of animals, if they had never seen a horse—they must admit, however, that he holds the second rank instead of the first—and it is principally from this circumstance that so little attention has been paid to him in both countries Comparison is the chief cause of his degradation—they look at and give their opinion not of himself, but comparatively with the horse. They seem not aware that he is a *mule*—that he has all the qualities of his nature, all the gifts attached to the connecting and final link of two distinct species, and think only of the figure and *qualities* of the horse which are wanting in him, and that he ought not to have; for he possesses those of more intrinsic value, which the Supreme Author of nature has denied to both of his parents.

There are few subjects of animated nature that have engaged the attention of the most eminent naturalists, more than the genus *Equus*, to which the horse and ass, with their *hybrid* offspring, are assigned. *Linnæus*, with a view to establish, by new arguments, his doctrine or theory of the *sexual system* of plants, which *Spallanzani* had attempted to overturn, illustrated their generation by pursuing the chain of nature from the animal to the vegetable kingdom; and has taken prominent examples from the two different productions of mules. He says, "From the mare and male ass proceeds the mule, properly so called, which in its nature, that is, in its medullary substance, nervous system, and what *Malpighi* calls the keel, (*carina*,) *bottom*, in sportsmen's language, is latent in, and derived from, the mare. But in its cortical substance and outward form, in its mane and tail, resembles the ass. Between the female ass and the horse, the other kind of mule is engendered, whose nature or medullary substance resembles that of the ass; but its outward form and cortical structure, or vascular system, that of the horse."*

The latter kind was called *Hinnus* by the ancients; hence the modern name *Hinny*. They were not held in much estimation by the Romans, according to Pliny, who describes them as difficult to manage, and so slow that little service could be derived from them. *Buffon* has noticed this animal, which, he says, "is smaller than the mule, as it preserves the diminutive stature of the ass." Hinnys were seldom propagated; but it is said that a number have lately been bred in Spain, probably in consequence of the destruction of mares in the peninsular war, and are represented of good size, and more beautiful than the mule; that is, they resemble the horse much more. I understand a few have been bred upon the Spanish Main, no doubt from a similar cause that led to the system in Spain; and if my information is correct, some have recently been shipped to the West India Islands, but are by no means esteemed so hardy, or valuable for service, as mules.

Notwithstanding mules have a disposition to propagate, there have been but two or three well authenticated instances recorded of their having *bred;* and those productions were considered monsters. *Buffon* was indefatigable in his researches on the subject; and although he admits that it is possible for both males and females to propagate, he is confident that their parents are of a species distinct from each other. He says, "The ass is not a horse degenerated," as some had supposed; "he is neither a stranger, an intruder, nor a bastard—he has, like other animals, his family, his species, and his rank; his blood is pure and untainted, and although his race is less noble, yet it is equally good, equally ancient as that of the horse." This profound naturalist continues a very minute and eloquent comparison between the horse and the ass—some of his expressions I have taken the liberty to apply to the *mule* and the horse in a preceding paragraph.

It may promote the object in view to enter extensively upon the history of the ass, and we commence with the supposition, that when men became so far civilized as to have burdens to *carry*, or required to be *carried* themselves, this animal was the first domesticated for that purpose—and it is reasonable to infer that those of the least *spirit* and most *tractable*, were put in requisition in the first instance; when by breeding *in and in*, without any care in the selection of *sire* or *dam*, became in process of time degenerated to a very inferior grade. Be this as it may, it is an unquestionable fact, that different races of the ass now exist, possessing properties as distinct as are found in the species of *camel*. For instance, the *Bactrain* or single hunched camel, called the *dromedary*, by far the most numerous race, being lightly formed, exhibits great activity, and is able to traverse vast tracts with the speed of a *high mettled race horse*. The *Arabian* camel, with two protuberances on his back, is considerably larger, of much stronger form, travels at a pace seldom exceeding three miles an hour, and is capable of conveying such burdens, that the Arabs style him, emphatically, the *ship of the desert;* yet they are of the same species—a cross between them breed and constitute another variety, which multiply, and according to Buffon, have the most vigor, and are preferred to all others.

Ancient writers recognize three or four distinct varieties of the ass. According to the learned Dr. Harris, four different races are indicated in the original Hebrew Scriptures, viz. *Para, Chamor, Aton*, and *Orud*.*

The wild ass, (*Para*,) was a native of *Arabia Deserta*, and those countries which formed the great *Babylonian empire*. They are now found in *Southern Tartary*, in the mountainous districts and saline plains of *Persia*—are migratory in large herds, visiting in winter the northern parts of *India*, and said to be so fleet that no horse can overtake them in the chase. This race are frequently alluded to by the inspired *poets* and *prophets;* and afford *similies* diametrically opposite to those drawn from the domestic race. The sublime description of the former in the book of Job, exhibits such a contrast, that I trust its insertion in this place will not be deemed improper.

"Who from the forest ass his collar broke,
And manumized his shoulder from the yoke?
Wild tenant of the waste, I sent him there
Among the shrubs, to breathe in freedom's air.
Swift as an arrow in his speed he flies;
Sees from afar the smoky city rise;
Scorns the throng'd street, where slavery drags her load,
The loud voic'd driver and his urging goad;
Where e'er the mountain waves its lofty wood,
A boundless range, he seeks his verdant food."
[SCOTT'S VERSION.]

We find, that at a very early period of sacred history, the common domestic ass (*Chamor*,) was employed in all the menial labors of a patriarchal family, while a nobler and more estimable animal (*Aton*), was destined to carry the patriarchs, *the well born*, and those on whom marks of distinction were to be conferred. They constituted an important *item* in a schedule of the pastoral wealth of those times; of course, attracted particular attention and care. *David*, we are told, had an officer, apparently of high dignity, appointed expressly to superintend his stud of *high bred asses*, or *Atonoth*.

There was another race that has been mentioned by *Aristotle*, and by *Theoprastus*, whom Pliny quotes, which they denominated the *wild mules* that *bred* (*hemi-onos*,) and were found in Cappadocia and Africa. There can be but little doubt but this is the *Hemionus*, or *wild mule* of the Mongalian Tartars, so particularly described by professor *Pallas;* and that it is not a *hybrid*, but actually of the species of ass resembling a mule. This race is identified by Dr. Harris with the *Orud* of Scripture.

The wild ass of Northern and Western Africa, whose flesh was so much admired by the Roman epicures, may, I believe, be ranked as another distinct race. Adanson, a French naturalist, who visited the river

* See "A Dissertation on the Sexes of Plants," by Sir Charles Linnæus—read before the Imperial Academy of Sciences at St. Petersburgh, Sept. 6, 1760, and which obtained the premium of one hundred ducats.

* See the "Natural History of the Bible, by Thaddeus Mason Harris, D.D., 1 vol. 8vo., Wells and Lilly, Boston." A work I would earnestly recommend to those readers of the sacred volume, who are desirous to be better acquainted with many allusions to subjects of natural history, founded on their nature, habits, and characteristic qualities, developing beautiful similies, which would otherwise lie concealed—and enabling them to judge more correctly of the propriety of such allusions.

Senegal more than half a century ago, describes those brought from the interior by the Moors, as so essentially different from any he had seen in Europe, (probably those of Spain, Savoy, or parts of France adjoining,) it was with difficulty he could recognize them to be the same species—neither do they answer the description of the wild ass of *Asia*, of which we have been speaking. But his account of them corresponds with the *diminutive* domestic race introduced from Africa, particularly those from *Senegal* and the *Cape de Verd Islands*; and from which the small race now in Europe and in this country, may with great probability claim their origin.

The *Arabian* ass, like the horse of that country, is considered as the most estimable of his species—and there are strong reasons for concluding that he is descended from the Hebrew *Aton*, so highly valued by Abraham and by the patriarchs, judges, and kings, at subsequent periods of sacred history; and that the same race has been preserved in the ancient *land of Uz*, in some degree of purity to the present time. Indeed, there can be but little doubt on the subject, if we admit the fact, that the habits, manners, and pursuits of the descendants of *Ishmael* have continued, with scarcely an *iota* of variation, from the day they took rank among the nations of the earth. The position is greatly strengthened by the information I received some years since, from an intelligent traveller of undoubted veracity, who had visited *Arabia* on the south-western side of the peninsula to *Mocha*; and on the eastern, as far as the mouth of the *Tigris*. He represented the *superior* race of asses of that country as most beautiful—of perfect symmetry, great spirit, activity, and vigor. He had seen those that could not be purchased for less than *four or five thousand dollars*—an enormous price, considering the value of money among these people.* I understand from him, that the Arabs were as tenacious of preserving the *pedigree* of their *horses*, as the most careful breeder for the *turf* in England—and not less so of their *asses*. The descent of some of them they trace to those in the train of the queen of Sheba, when she visited Solomon—as they also do that of their *horses* to the numerous *stud* of that wise and gallant king.

Dr. Harris supposes the *wild ass* (*Para*,) to be the *Onager* of the ancients; and that the *Aton* was of a different kind. My impressions coincide with the opinion of the learned divine—but may not writers of different periods have confounded the wild ass with the Aton in their representations of *Onager?* for it is not improbable, but that the *Aton* was of the most improved breed known, produced from crosses of a choice selection of the domestic, the wild ass, and the Hemionus, or wild mule—which last professor Pallas recommends to complete the perfection of the species. This supposition is supported by *Buffon*, who infers as a certain fact, that by a cross of the remotest of different races of the ass, the most beautiful productions are obtained.

Mules were in use and highly esteemed at a remote period of antiquity; and are mentioned in Scripture as of importance in the equipage of princes. Herodotus, who is styled the *father of profane history*, frequently speaks of them; and it is known that they were introduced in the *chariot races* at the Olympic games, in the seventieth Olympiad, about five hundred years before Christ. The Romans well knew their value. Pliny informs us, from Varro, that *Q. Axius*, a Roman senator, paid four hundred thousand sesterces, upwards of *thirteen thousand dollars*, for a *mule ass*, for the propagation of mules. And he says further, that the profit of a *female ass* in breeding stock for the same purpose, was estimated in *Celteberia*, now the kingdom of Valencia, in Spain, at a like sum. We may infer from a passage in *Tacitus*, and in Plutarch's life of *Marius*, that *mules* were generally employed to transport the baggage of the Roman armies; and that it is not improbable the superior officers rode those of a high grade, having their horses led, except when they engaged an enemy. It seems that the *dilletanti* of Rome held them in great estimation; as we are informed that the mules of *Nero* and *Poppea* were shod with *gold* and *silver*—not *plates*, as iron shoes are now formed, but the *whole hoof* enclosed.

Columella, who in the reign of Emperor Claudius published the most valuable treatise on the husbandry and economy of the Romans that has been handed down to us, has given very particular directions for breeding *asses* and *mules*. He was a native of *Cadiz*, and owned estates in Spain, where it appears that the finest mules were then bred.

As it is not requisite to pursue our history of the mule any farther among the ancients, we shall drop their appellation of *male* and *female ass*, and adopt the modern one of JACK and JENNET.

Spain has continued to support the reputation for a superior race of mules to the present period; and it is probable that the Arabian breed of Jacks were introduced by the Moors, when they held possession of that fine country, which, by crosses, and the effects of climate and soil, have formed two valuable races: which we shall notice in the sequel. The Portuguese race have been generally considered as differing but little from the Spanish; those, however, that have come within my view appear evidently inferior. It was not until near the close of the sixteenth century, that *coaches* were used in France; before which, it is said, the nobles rode to court, parliament, &c., on *mules* that were brought from the vicinity of the Alps and Pyrenees. They were usually black, of large size, well made, and mostly bred from fine *Spanish mares*. Savoy has long been noted for an excellent breed of mules. None very extraordinary are found in Italy, those used by the *Velterino*, are strong and of a respectable size, but of a sluggish and debased spirit. Very little can be said of those animals in Great Britain. The Catholic prelates brought over a number of superb mules, prior to the Reformation, but in the reign of *Elizabeth* so little was known of them, that a writer of that peaiod says, "in Devonshire some were produced by a *Jack* brought from France, and were *knocked on the head* by the people, who viewed them as monsters." A superior race of mules were bred in *Flanders*, from Jacks introduced by the Spanish monarchs while they held dominion in that country. Fifty of them were brought to England by the *Duke of Cumberland*, presented him by the *Empress Queen*, and from their beautiful appearance engaged the attention of a few individuals; but the spirit soon subsided. Notwithstanding those who bred and used them, were warm in praise of their utility.

Among a voluminous mass of treatises on agriculture and rural economy, published in that country for near a century past, scarce a line can be found devoted to the mule, except by *Dr. Anderson*, who, in his "Recreattons in Agriculture," has made a few judicious remarks on the subject.

In Sir George Staunton's account of Lord Macartney's embassy to China, we are told that mules are valued in that economical empire, at a much higher price than horses. In our own country, prior to the war of the revolution, a few Jacks of an ordinary kind were imported—a small number of mules bred; and all exported to the West Indies. I have reference to New England, as I am not aware that any attention was paid to the system in the Middle, or Southern States, tnough it is not improbable that valuable mules may have been raised by the farmers and planters for their own use. When peace took place, the price of mules in the West Indies excited attention to the breeding of them, which was principally confined to Connecticut; and several cargoes of the small race of Jacks were imported from the Cape de Verd islands, and St. Michael's, one of the Azores. It should be observed that the exportation of Jacks from Spain, or any of her colonies, was strictly prohibited, and continued to be until after the Peninsular war. There might have been, however, a few smuggled from the Spanish part of Hispaniola into Cape Francois, and from thence introduced, but they were vastly inferior to the Spanish Jacks. From this miserable stock a system of breeding mules commenced, the best calculated to deteriorate any race of animals that has been, or could be devised, since their creation. The purchaser of a *Jack* when about to commence *mule dealer*, made little inquiry concerning him but of his capacity to *propagate* a mule. He placed him in a district where there was the greatest number of mares of qualities so *inferior*, that their *colts* would not compensate their owners for the expense of taking them to a *horse*, and contracted to purchase their mules at four months old. Those are kept in herds, with precarious shelter in winter, having ample opportunities afforded them to mature and transfer that propensity for *kicking*, which seems at first merely playful, into an habitual means of defence, to be exercised when the *biped* or any other race of animals approach them. In this *kicking seminary* they remain two years, and are then driven to market. At subsequent periods, a few Jacks of higher grades were procured, from which a small number of good sized mules were bred, and a few of them broke. The breed of Jacks have somewhat improved, and *mule dealers* are now locate in most of the New England States, and some parts of New York. But the system as above detailed, with few exceptions, has continued; and it is from such a race of Jacks, and such a system of breeding and management, that the mules have been produced, with which the farmers and planters of *Maryland*, *Virginia*, and the *Southern States*, have been supplied from New England; and such have furnishad a criterion for a great portion of our countrymen to form an estimate of the value and properties of this degraded animal. It affords great pleasure to be enabled, for a short time at least, to pursue our investigations in a higher sphere.

Several of my friends who had viewed the Jacks and mules at Mount Vernon, in the life time of Gen. Washington, gave such glowing descriptions of them, and understanding that part of that stock was inherited by George W. P. Custis, Esq., I was induced to address a few queries to him on this subject; this gentleman with his characteristic

* Neibuhr remarks, "there are two sorts of asses in Arabia: the smaller, or lazy ass, as little valued there as in Europe; and a large and high spirited breed, which are greatly valued, and sell at a very high price; I preferred them to the horse." See Neibuhr's Travels in Arabia.

urbanity, very promptly furnished replies, with liberty to make such use of them as I pleased, and I cannot do better than to transcribe them from a letter received about three years since. Mr. Custis observes:

"The ROYAL GIFT and KNIGHT OF MALTA, were sent to General Washington about the year 1787;—the *Gift*, with a JENNET, a present from the King of Spain; and said to have been selected from the royal stud. The *Knight* I believe was from the Marquis de la Fayette, and shipped from Marseilles. The *Gift* was a huge and ill shaped Jack, near sixteen hands high, very large head, clumsy limbs, and to all appearance little calculated for active service; he was of a grey colour, probably not young when imported, and died at Mount Vernon but little valued for his mules, which were unwieldy and dull. The *Knight* was of a moderate size, clean limbed, great activity, the fire and ferocity of a tiger, a dark brown, nearly black colour, white belly and muzzle; could only be managed by one groom, and that always at considerable personal risk. He lived to a great age, and was so infirm towards the last as to require *lifting*. He died on my estate in New Kent, in the State of Virginia, about 1802 or 3. His mules were all active, spirited, and serviceable; and from *stout mares* attained considerable size.

"General Washington bred a favourite Jack called COMPOUND, from the cross of Spanish and Maltese. The *Knight* upon the imported Spanish *Jennet*. The Jack was a very superior animal; very long bodied, well set, with all the qualities of the *Knight*, and the weight of the Spanish. He was sire of some of the finest mules at Mount Vernon, and died from accident. The General bred mules from his best coach mares, and found the value of the mule to bear a just proportion to the value of the dam. Four mules sold at the sale of his effects, for upwards of $800; and two more pairs at upwards of $400 each pair; one pair of these mules were nearly sixteen hands high. The only Jacks I know of at present, of the genuine Mount Vernon stock, are, one sold by me to Judge Johnson, of South Carolina, for five hundred dollars, at two years old; one given by me to William Fitzhugh, Esq., of Ravensworth, and one which I believe is possessed by my uncle, George Calvert, Esq., Riversdale.

"The Jack purchased by Judge Johnson, I have understood, has a very high reputation in the south.

"Upon losing my groom, (Peter) who was the first and last groom to the Mount Vernon Jacks, I parted with my stock.

"There are many Jacks that have come into the country of late years, but of their value and properties I am unable to speak: though I rather presume that they are generally small, and only fitted to get mules for the cotton cultivation in the light lands of the south. Some very fine mules are raised about Hagerstown, Maryland, from Jacks of the old breed; they are bred from stout wagon mares.

(To be continued.)

From the American Gardener's Magazine for March.

CULTIVATION AND FORCING OF THE CUCUMBER; TAKEN FROM HORTICULTURAL MEMORANDA, AND EXHIBITING THE STATE OF THEIR PROGRESS FROM JANUARY UNTIL SEPTEMBER. BY THE CONDUCTORS.

JOURNAL.

January 20th, 1832.—The weather, all the month, up to this date, has been very fine, and accompanied with but little severe cold, the thermometer indicating an average temperature, at one o'clock, P. M., of about 4° above freezing (32°). Considerable snow lies upon the ground, which fell in the month of December last. Preparations, however, have been made, to put the pit into operation. The soil which remained in the bed (about four inches in depth) being somewhat frozen, the sashes have been placed on, and the front doors covered with straw or hay: at night, the sashes have been covered with mats and hay, in order that the heat from the sun during the day might be retained. One or two squares of glass which were broken have been repaired, and every thing put in readiness to proceed with the forcing. [We have memoranda taken from the year 1830 to the present time. The reason why we select that of 1832, is, that we were more successful in our mode of cultivation than the two years previous. The quantity of fruit was considerably greater, and the vines much more luxuriant; the forcing was also commenced nearly two months sooner. From the latter cause alone, we have selected the above named year, as the later forcing is commenced, the easier it is carried on,—the inclemency of our winters, the great quantity of snow which often falls, and the severe cold, rendering it extremely difficult and uncertain in the months of January and February; and where the old hot bed system is pursued, the labor and uncertainty is still greater. In the following notes, extracted from our Journal, we have occasionally added some observations. But we think this method will be better understood, than if we made no reference to dates, and merely detailed our mode of cultivation.]

Jan. 21st. The snow, which commenced falling last evening, and continued through the night, covering the ground to the depth of about two and a half inches, has rendered it somewhat inconvenient to add the manure to the pit to-day. Temperature in the open air, at sunrise, 33°.

23d. This morning the mercury fell as low as 5°. The soil in the bed still remains partly frozen; but the sun shining very bright, has thawed the surface. Ten barrows of manure, fresh, and in a good state of fermentation, were added to-day. The doors were closed tight, and hay and straw put against the crevices, and in front of them, by placing up square pieces of board. The sashes were covered at night with one thickness of bass mats; on top of these, soft hay, to the thickness of three or four inches, and on the hay, one more thickness of mats. A few narrow strips of boards were then put on, to prevent the wind from blowing the covering off, should it blow violently during the night.

24th. The weather to-day moderate; temperature, at sunrise, 29°; cloudy, and little misty. Added eight barrows more of manure, and stirred the whole well together. Covered up as on the previous evening.

25th. Rainy; temperature 50°, and to-day the heat in the bed began to rise; temperature 50°, at sunrise. The sashes covered, as mentioned the 24th, every night.

26th. Temperature, at sunrise, zero; snow fell during last night, to the depth of five inches. Temperature of the bed, at sunrise, 50°.

27th. Temperature, 13° below zero. In consequence of the extreme cold, could not open the bed without the fear of losing much heat. Temperature of the bed, 54°.

28th. Thermometer 8° below zero. Cucumber seed planted to-day. The kind best adapted to forcing being considered the *true* Southgate, this kind was planted. The soil in the beds being composed almost wholly of well decayed leaves (but a small portion of common garden earth being added), pots four inches in diameter at the top, and four deep, were filled with it: two or three small pieces of broken pots we first placed over the hole in the bottom of each.

The seeds were then sown, three in each pot, covering them about half an inch deep: the pots were then plunged under the centre light, in the middle of the bed, bringing them up as nigh as possible to the glass, that they might receive all the benefit of the air admitted into the bed. Thus prepared, the sashes were shut tight, and at night covered up warm. This variety (the Southgate) we have found to be the best, having tried it for several years: the seed is rarely to be found of genuine quality; and, from this cause, it has been pronounced inferior, by some growers; but we believe no kind to be earlier, or give a greater quantity of fruit. Temperature of the bed, 65°; of the soil, 75°.

29th, 30th, 31st. Weather more moderate, with rain; the air in the bed has now acquired a greater heat, as also the soil.

February 1st. The heat of the bed to-day is very brisk. The bright sunshine and the moderate temperature of the weather, combined, air is admitted in greater quantity. From the want of this, the plants which appeared above the soil in the pots this morning, are somewhat drawn up, and show the greater necessity of giving air when the seeds are in the first state of vegetation, as well as when the plants are in a more advanced and progressive age. It is a striking instance of the want of air, as well as light, to see the cotyledons, or seed leaves, of plants thickly sown, as soon as they appear above the ground, stretch forward eagerly to cath the first glance of the sun's reviving rays, each one seeming to advance above the other, as if fearing it would be deprived of an equal portion of his refreshing power. Air was admitted about 11 o'clock in the forenoon, by tilting up the sashes at the back of the pit about half an inch. If the air is sharp, a bass mat should be laid over the apertures, to prevent the plants being too suddenly chilled. A pan of soft water was placed in the bed this morning, to become heated to the same temperature, in order to water the plants as soon as needed. The plants looking thus flourishingly, if the weather continues moderate, a good growth may be expected. To give the temperature of the air in the bed, as well as the soil, as taken three times each day, would occupy considerable room; we have therefore concluded, from the want of space, to give the temperature every three or four days (three times each day, viz., morning, noon and night), it varying very little in the intermediate time. We think this a better mode than to give a long table of figures for each month. The dates will, also, only be given when any thing of importance has occurred; as, often, for two or three days, nothing was done but to give air each day; watering the plants, if requiring it, and covering up the sashes at night. The covering up of the sashes is very important, as it tends greatly to keep an even temperature. That which we have found to answer the best purpose, and guard against the cold in the most efficient manner, was a covering of mats and hay, laid on as mentioned previously: this should be continued until April, on no account omitting a single night, however favorable the weather may be at sunset; for we have repeatedly known the thermometer to stand at 32° at that time, and fall as low as zero before daylight.

4th. Temperature of the air in the bed, 64°, 75°, 66°; of the soil, 75°. Air was admitted in greater quantity to-day, the sashes being opened an inch at the back. The plants were slightly watered. Three pots more of cucumber seeds were sown to-day, in order to have a few plants to replace the others, should they meet with any accident by which their growth would be retarded. We have sometimes had those of the first sowing damp off when the weather had continued cloudy for some days, especially when they were first hilled out, it being very difficult to prevent this; while those still growing in pots can be kept dry or moist at pleasure; and answer, as a resource, in any case.

7th. To-day, two barrows of fresh manure were added, the heat having subsided a little. Temperature, 60°, 64°, 60°; of the soil, 70°; this being too low for their successful growth.

10th. The plants of the last sowing, up to-day; look healthier than the first, from their longer time of vegetating. The temperature of the open air being moderate, (above 32°,) and the weather fine, more air was given; the plants acquiring more strength and vigor every day.

14th. Added four barrows of manure to the pit to-day: Temperature, 64°, 65°, 63°; of the soil, 75°. Cucumbers of the first sowing, show their rough leaves.

17th. Heat brisker, and more air admitted. Temperature, 66°, 66°, 64°. The plants being in a vigorous state of growth, a barrow of soil, composed of two thirds leaf mould, and one third light loam, was added to the bed, and placed under the centre of each light, that it might become heated, and ready for hilling the plants into, in a day or two.

20th. Plants hilled out to-day. The soil was raised up to within eight inches of the glass; a hole sufficiently large to receive the plants was made in each hill, and turning them from the pots, very carefully, so as not to disturb the soil, were placed therein; the earth was drawn up round the stems of each, close to the seed leaves, as from the stems roots proceed; and the plants grow much more stocky and strong, and are less liable to damp off. A light sprinkling of water should be given, and the sashes closed, that a gentle steam may be generated, which will greatly refresh the plants. This operation should be performed in the middle of the afternoon of a fair day.

24th. The sudden change of the weather since yesterday, has caused a decline of the heat in the bed, and four barrows of fresh manure were added to-day; the ends of the roots of the plants having protruded through the soil, and shown themselves on the surface, more earth was drawn up round the hills, and the plants sparingly watered. Temperature, 60°, 60°, 60°; of the soil, 70°.

27th. The second rough leaves of the plants begin to show themselves to-day; the heat of the bed having become very brisk, since the addition of the last manure, the plants are growing rapidly; the weather being more moderate, considerable air was admitted. The pan for containing water should be kept constatly filled, ready for use.

March 1st. During the last month the covering was taken off of the bed, between nine and ten o'clock in the morning, according to the severity of the weather; but oftener at the latter than at the former hour: it was also covered up as soon as the sun's rays left the sashes. During this month the sun shining with greater power, it should be uncovered as early as nine o'clock in the morning, the former, and at half past eight, the latter part of the month, and should be covered in the afternoon, as early as five o'clock in the former, and at half past five the latter part of the month. A quantity of leaf mould and loam should, on the first opportunity, be collected together, and in readiness to earth round the plants. No kind of soil answers so well for cucumbers, during the first month of their growth, as decayed leaves; indeed, we have seen it alone recommended as the best throughout the growth of the plants, from the sowing of the seed to the maturing of the fruit: we have, however, always found that the plants run too much to vines in such a soil, and, although the fruit was the largest, of the deepest tint of green, and in every way superior, both as regards appearance and quality, still we believe a small portion of light loam added to the above named soil, when the plants have been hilled out a week or two, renders the vines more prolific of fruit, and less luxuriant and rapid in their growth. We have measured leaves on our vines *fifteen inches* in diameter. We once had the pleasure of showing our plants, when in a vigorous state of growth, to an excellent practical gardener, who had grown cucumbers for many years; he appeared astonished at their luxuriance, and hinted that some extraordinary pains had been taken with them; the soil showed for itself, and pure water alone had been made use of; but so certain was our friend that they had received *stronger food*, that, although we most positively averred such was not the fact, we could not convince him to the contrary, and he left us firm in his own suspicions.

The plants were all topped at the first joint, at this time; this is an operation upon which there is a variety of opinions; some stating that it injures the vines, without attaining the end in view; others that they are benefitted in a great degree; some, that it is a matter of little consequence, neither forwarding nor retarding the forcing; and others, that the period of producing fruit is materially shortened. The object of the operation is to keep the plants from running too much to vines,—thus filling the bed without producing fruit,—and to render them at once fruitful, by forcing them to throw out, first, blossoms, and afterwards, runners. We have tried both methods, as well as the experiment of pinching off some plants at the first, some at the second, and some at the third joint: as regards the three latter modes, there is but a slight difference; indeed, at the first or second joint, none; but to let the plants grow without stopping them at all, we have found a very bad practice, and one which we cannot too strongly guard the young practitioner against pursuing. We would here suggest to those, who would wish to satisfy themselves fully upon this subject, the propriety of instituting a series of experiments, which may be thus performed:—Let four hills of plants be taken; pinch off the plants in one hill, at the first joint; in the second, at the second joint; the third, at the third joint; and in the fourth, let the plants take their own course: when they come into blossom, let the time be noted down, as also, when they come into fruit; this will give a correct and satisfactory view of the practice. It is from such observation that we are enabled to state actual results. There has been so much written upon this seemingly trifling subject, and so much doubt still exists, with many gardeners, that we have been thus particular in our remarks. Temperture, 68°, 72°, 68°; of the soil, 78°.

5th. The weather becoming more mild, the bed retains the heat; the plants are daily sprinkled with water warmed to the temperature of the bed, and the sashes shut down early in the afternoon, in order to cause the steam to rise, as this greatly refreshes the plants. There is no better sign that they are in a flourishing state, than when, on opening the sashes in the morning, small drops of water stand on the edges of the leaves; when this is not perceived, the air is not moist enough, and a slight sprinkling of water should be given, upon closing the sashes at night. The plants, till the middle of the month, should be watered about ten o'clock in the morning. Temperature, 68°, 80°, 68°.

7th. A barrow full of soil (leaf mould and loam) was added to-day: the roots again showing themselves on the surface of the hills, as soon as it became well warmed, it was drawn up over them; the plants look strong, and now require considerable water. Temperature, 66°, 68°, 66°.

10th. To-day, three barrows of the old manure were taken out, and three of fresh added in the room. The plants have now attained a good size, and begin to show flower buds. More soil was drawn over the surface of the hills, and the plants watered more freely. Temperatuae, 62°, 78°, 70°; of the soil, 80°.

13th. Weather continues moderate; the heat of the bed very brisk, since the addition of the last manure. More soil was added, to be in readiness to earth round the plants; it is very important that this should, as well as all soil that is added, be put in three or four days before wanted for use; always placing it near the back of the bed, in order that it may be easier warmed, the sun shining with its full force upon it. The moisture is sooner evaporated, than it would be in the front of the bed; and as, early in the season, it often happens, that it cannot be procured only in a very wet state, it is desirable to place it in this situation. Temperature, 66°, 82°, 70°; of the soil, 85°.

17th. Heat still continues rather brisk, and the plants are growing very finely. The roots again showing themselves on the surface of the hills, the soil was drawn over them, which was placed in the bed three or four days since. The object in hilling up the plants from time to time, as well as the addition of soil to the bed at different periods, rather than adding all at once, is to prevent dampness, and a diminution of heat from the quantity of moisture which the soil would contain. The plants now require considerable water, which should be given, from time to time, as soon as the sun's rays leave the sashes. Temperature, 65°, 65°, 63°; of the soil, 70°.

20th. The inclemency of the weather, the last three days, has caused the heat of the bed to abate considerably, and, in consequence, two barrows of old manure were removed, and three of fresh added. We would here mention, that, when fresh manure is added, it should be in a moist state: to put it in, as it is frequently taken away from the stable heap, in a *dry* heat, is a very injudicious practice, and should be carefully avoided. When, however, no other is at hand, the barrows full, as they are taken to the bed, should have two or three pails of water added to each, and the whole, when thrown into the pit, well forked together. We have occasionally opened the doors, and thrown in several pails of water, and after the whole was well forked up, the heat would be brisk for four or five days. This should not be forgotten, as it is a saving of considerable manure, where it is not easily to be had, but is brought from a considerable distance.

23d. Heat very brisk. Temperature, 69°, 86°, 76°; of the soil, 85°. Plants in a vigorous condition, and some flower buds almost expanded. A barrow full of compost of the same kind as before used was added to the bed. Water freely supplied to the plants in fine weather. Some small pegs must now be prepared, to fasten down the vines, as they proceed in growth; this practice is very beneficial to the successful cultivation of the cucumber, as, in the latter part of the forcing, when the vines have filled the bed, the roots, which are thrown out into the soil at every joint, where pegged down, greatly assist in giving additional food and nourishment to the plants as they extend. The old portion of the vines near the root sometimes becomes cankery, and in particular when this is the case, the fibres at the joints afford that support which is cut off from the main roots. These pegs may be made of any small pieces of brush, by taking the part where the branches fork out. Use one at every joint.

27th. The weather has become very moderate; the thermometer, in the open air, indicating 70°. The heat of the bed has been well retained, and less covering at night required. The roots of the vines have again appeared, and the soil was drawn round the hills to the thickness of about three inches, fully covering all the extreme fibres of the roots: it is astonishing with what rapidity they now extend themselves: we have seen them run through a thickness of soil of one inch during the night. One or two staminate (or male) blossoms opened to-day, and several buds, with embryo fruit, are nearly ready to expand. Temperature, 70°, 76°, 70°; of the soil, 82°.

30th. Removed three barrows of manure, and added three of fresh. The pistillate (or female) flowers, those which show the embryo fruit, have opened to-day, and the operation of "setting the fruit," as it is generally termed, was performed. The propriety of this operation having been disputed by many, and as there are various opinions respecting its usefulness, we intend to make some remarks in relation to it; but, as we have extended this communication to a greater length than we expected, or than we have space, at the present time, we leave it until a future opportunity.

(To be continued.)

TO BRIDGE BUILDERS.

Sealed Proposals will be received, until the 15th of April, for finding materials and building the superstructure of a bridge, over Harlem Creek and flats, on the New York and Harlem Railroad.

Said Bridge to be on the late improvement of Mr. Town, 24 feet wide in the clear, and 660 feet long between the abutments, to be supported by three piers of masonry. The bridge to be completed by the 1st of Nov. ensuing. Communications may be addressed to the undersigned, at his office, No. 9 Chambers street, where plans and specifications may be seen.

JOHN EWEN, Jr.
Engineer of the New York and Harlem Railroad.
9-t15a

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at 212 Grand street, New-York.

TO CONTRACTORS.

NOTICE is hereby given to all persons who may feel disposed to take Contracts on the Illinois and Michigan Canal, that the Board of Commissioners have determined to commence that work as early in the spring as circumstances will permit. The Engineers will commence their surveys about the 10th of March, and will have several Sections ready for contract by the first of May. It is therefore expected that definite proposals will be received from that date to the first of June. In the mean time the Board invite an early inspection of that part of the route to Chicago, and will afford any information that may be required of them.

All communications will be addressed to "The Board of Commissioners of the Illinois and Michigan Canal, at Chicago."

By order of the Board.
JOEL MANNING, Secretary.
January 20, 1836. 8-6t

☞ THE NEWCASTLE MANUFACTURING COMPANY, incorporated by the State of Delaware, with a capital of 200,000 dollars, are prepared to execute in the first style and on liberal terms, at their extensive Finishing Shops and Foundries for Brass and Iron, situated in the town of Newcastle, Delaware, all orders for LOCOMOTIVE and other Steam Engines, and for CASTINGS of every description in Brass or Iron. RAILROAD WORK of all kinds finished in the best manner, and at the shortest notice.

Orders to be addressed to
MR. EDWARD A. G. YOUNG,
Superintendent, at Newcastle, Delaware.
feb 20—ytf

AMES' CELEBRATED SHOVELS, SPADES, &c.

300 dozens Ames' superior back-strap Shovels
150 do do do plain do
150 do do do cast steel Shovels & Spades
50 do do Gold-mining Shovels
100 do do plated Spades
50 do do socket Shovels and Spades.

Together with Pick Axes, Churn Drills, and Crow Bars (steel pointed), manufactured from Salisbury refined Iron—for sale by the manufacturing agents,

WITHERELL, AMES & CO.
No. 2 Liberty street, New-York.
BACKUS, AMES & CO.
No. 8 State street, Albany.

N. B.—Also furnished to order, Shapes of every description, made from Salisbury refined Iron. 4—ytf

PATENT RAILROAD, SHIP AND BOAT SPIKES.

☞ The Troy Iron and Nail Factory keeps constantly for sale a very extensive assortment of Wrought Spikes and Nails, from 3 to 10 inches, manufactured by the subscriber's Patent Machinery, which after five years successful operation, and now almost universal use in the United States, (as well as England, where the subscriber obtained a patent,) are found superior to any ever offered in market.

Railroad Companies may be supplied with Spikes having countersink heads suitable to the holes in iron rails, to any amount and on short notice. Almost all the Railroads now in progress in the United States are fastened with Spikes made at the above named factory—for which purpose they are found invaluable, as their adhesion is more than double any common spikes made by the hammer.

☞ All orders directed to the Agent, Troy, N. Y., will be punctually attended to.

HENRY BURDEN, Agent.

Troy, N. Y., July, 1831.

☞ Spikes are kept for sale, at factory prices, by I. & J. Townsend, Albany, and the principal Iron Merchants in Albany and Troy; J. I. Brower, 222 Water street, New-York; A. M Jones, Philadelphia; T. Janviers, Baltimore; Degrand & Smith, Boston.

P. S.—Railroad Companies would do well to forward their orders as early as practicable, as the subscriber is desirous of extending the manufacturing so as to keep pace with the daily increasing demand for his Spikes.

1J23am H. BURDEN.

RAILROAD CAR WHEELS AND BOXES, AND OTHER RAILROAD CASTINGS.

☞ Also, AXLES furnished and fitted to wheels complete at the Jefferson Cotton and Wool Machine Factory and Foundry Paterson, N. J. All orders addressed to the subscribers at Paterson, or 60 Wall street, New-York, will be promptly attended to.

Also, CAR SPRINGS.

Also, Flange Tires, turned complete.

J8 ROGERS, KETCHUM, & GROSVENOR.

STEPHENSON,

Builder of a superior style of Passenger Cars for Railroad.

No. 264 Elizabeth street, near Bleecker street, New-York.

☞ RAILROAD COMPANIES would do well to examine these Cars; a specimen of which may be seen on that part of the New-York and Harlem Railroad now in operation. J2ef

PROPOSALS

FOR THE REPUBLICATION OF THE REPORTS OF THE BALTIMORE AND OHIO RAILROAD COMPANY;

Condensed so as to include, together with other matter added thereto, all that is known at the present day of the location and the application of Motive Power and Machinery thereupon, accompanied with explanatory drawings. The whole being intended to serve as a Manual of the Railroad System, for the use of Civil Engineers, to which is prefixed a history of the Baltimore and Ohio Railroad Company.

The work, whose republication it is thus intended to republish, was the first of any extent commenced in this country for the purposes of general transportation; and its early history is but a series of experiments, costly to the Company which had it in charge, but furnishing results of the greatest value and importance to others. The character of the country through which the road passed, involved every species of excavation; and in the construction of the Railway, almost every mode was successively tried for the purpose of ascertaining the best. While portions of the road were straight, others were of the smallest admissable curvature, and the locomotive power employed had to be such, therefore, as was suitable to both cases. This led to a series of experiments in this department of the Railroad System, which has resulted in the production of Engines preferable to any in use elsewhere—equal in speed to the best imported, and far superior in efficient power. From all these circumstances, the reports of the Baltimore and Ohio Railroad, from its commencement to the present day, have been sought for by Civil Engineers for the sake of the knowledge which they contain, and the frequent demand for them has suggested to the subscriber their republication, with such additional matter as shall constitute a Manual of the Railroad System in the present state of knowledge on the subject.

The reports are now difficult to be procured, and but few complete sets are known to be in existence. While the proposed republication will therefore be of use to the profession of Civil Engineering, it will be the means also of preserving the records of a work whose importance and value are now universally appreciated. The work will be divided into five parts.

I. History of the Baltimore and Ohio Railroad Company.
II. The location of Railroads, including the principles of reconnoissances, general instrumental surveys, and location for construction.
III. The construction of Railroads, including the excavation and masonry and the construction of the Railway on the graduated surface, turnouts, weighing, &c.
IV. The motive power including engines, cars, wagons, &c.
V. Forms of contracts for every species of work which has to be performed in the construction of a Railroad.

☞ As it is not practicable to ascertain what sized volume or volumes the contemplated work will make, the price cannot be fixed, but Railroad Companies and individuals who may subscribe for it, may rest assured, that it will be made as reasonable as the nature of it will permit Orders directed to

F. LUCAS, Jr. Publisher,
Jan., 1836. No. 133 Market street, Baltimore.

ARCHIMEDES WORKS.

(100 North Moor st. N. Y.)

NEW YORK, February 12th, 1836.

The undersigned begs leave to inform the proprietors of Railroads that they are prepared to furnish all kinds of Machinery for Railroads, Locomotive Engines of any size, Car Wheels, such as are now in successful operation on the Camden and Amboy Railroad, none of which have failed—Castings of all kinds, Wheels, Axles, and Boxes, furnished at shortest notice.

H. R. DUNHAM & CO.
4—ytf

RAILWAY IRON.

95 tons of 1 inch by	¼	inch.,		FLAT BARS in lengths
200 do.	1¼	do.	¼	do. of 14 to 15 feet, counter
40 do.	1½	do.	¾	do. sunk holes, ends cut at
800 do.	2	do.	½	do. an angle of 45 degrees,
800 do.	2½	do.	⅝	do. with splicing plates and
soon expected.				nails to suit.

250 do. of Edge Rails of 36 lbs. per yard, with the requisite chairs, keys and pins.

Wrought Iron Rims of 30, 33, and 36 inches diameter for Wheels of Railway Cars, and of 60 inches diameter for Locomotive Wheels.

Axles of 2½, 2⅝, 2¾, 3, 3⅛, 3¼ and 3½ inches in diameter, for Railway Cars and Locomotives, of patent iron.

The above will be sold free of duty, to State Governments and Incorporated Governments, and the drawback taken in part payment. A. & G. RALSTON,

9 South Front street, Philadelphia.

Models and samples of all the different kinds of Rails, Chairs, Pins, Wedges, Spikes, and Splicing Plates, in use both in this country and Great Britain, will be exhibited to those disposed to examine them. 4—d7 1mosw†